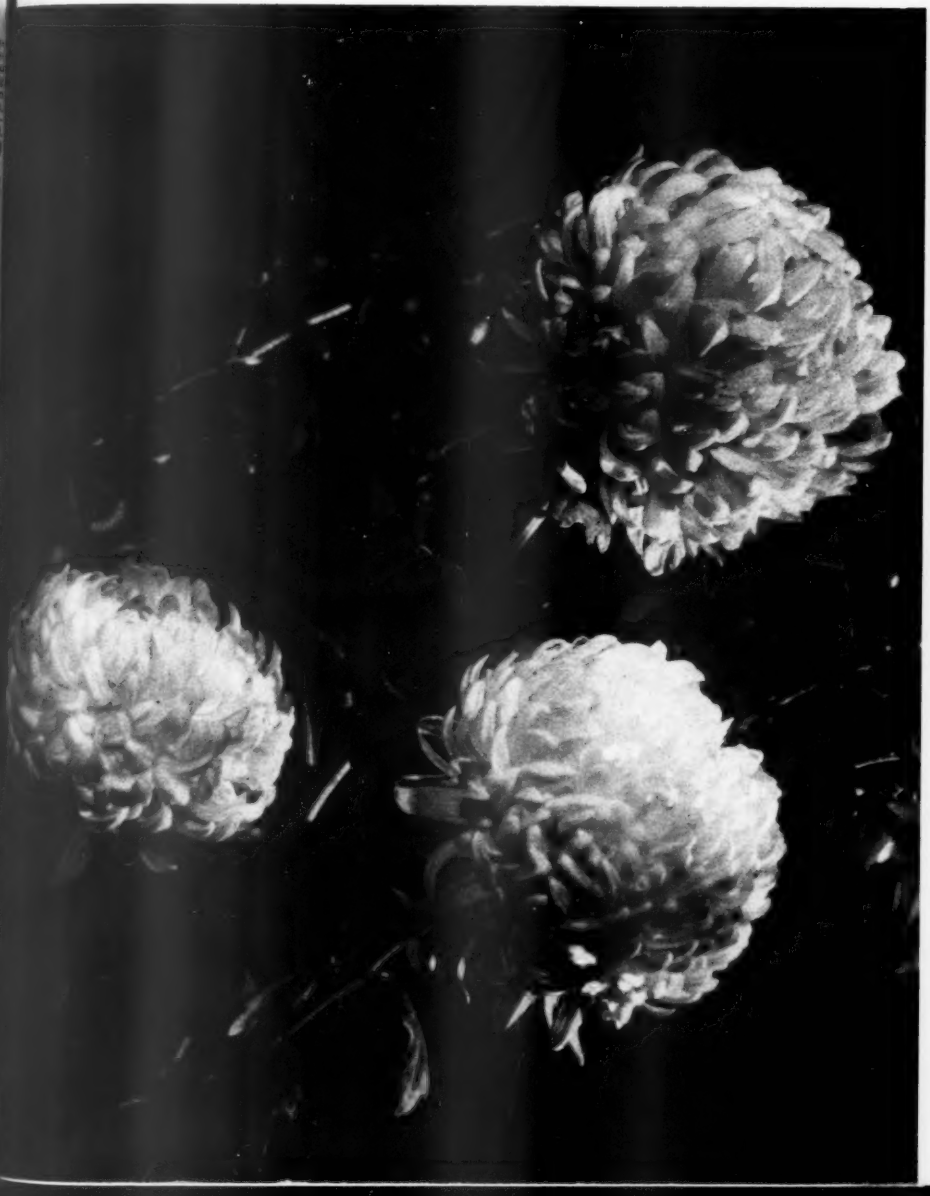
December 1948
25 Cents

Organic Gardening

GARDENING AND FARMING WITHOUT CHEMICALS



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2.—**MANUAL OF ORGANIC MATERIALS. A Comprehensive List of Compostable Materials Occurring in the Home and in Industry.** This book alphabetically lists 85 substances that may be used to keep the soil fertile in Nature's way. It defines the composition of each material and what each substance contributes in plant nutrients to the soil. . . 50c

3.—**BULBS AND HOUSE PLANTS** by Cecile Hulse Matschat. Discusses tulips, iris, lilies, peonies, etc. 60c

4.—**ANNUALS AND PERENNIALS** by Cecile Hulse Matschat. Describes the advantages of annuals over perennials and vice-versa. 60c

5.—**HOUSE AND GREENHOUSE GARDENING** by Fred McCready. Deals with inexpensive means for growing plants in your house and under glass in hot-beds and greenhouses. 1.00

6.—**GARDENING WITH THE EXPERTS** by Garden Experts. An encyclopedia on all phases of gardening. . . . 1.00

7.—**THE WAR IN THE SOIL** by Sir Albert Howard, C.I.E., M.A. A magnificent summary of the organic cause for those who desire to change from ordinary to home-made organic fertilizer. 80c

8.—**SEEDLINGS** by Evelyn Speiden. How to start seedlings—how to prepare the garden. 1.00

9.—**VEST-POCKET VEGETABLE GUIDE** by Roger W. Smith. How to grow 40 vegetables in the organic manner—for medium northern climate. 25c

10.—**COMPLETE MODERN GARDEN HERBAL** by Robert O. Barlow. Many facts about herb gardening and usage in several lands. 1.00

11.—**THE FRUIT ORCHARD** edited by J. I. Rodale. Practical hints, unusual data on fruit growing. 50c

12.—**LEAVES AND WHAT THEY DO** by Heinrich Meyer. Deals with the leaf's importance to the gardener and lover of plants. 45c

13.—**SUNFLOWER SEED—THE MIRACLE FOOD** by J. I. Rodale. Treatise on how to grow, how to eat this vitamin-rich food. 35c

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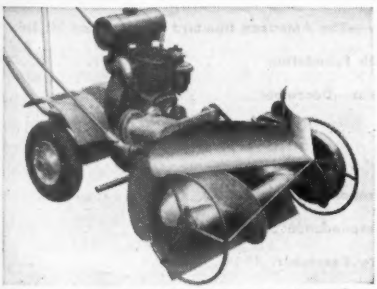

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Organic Gardening

Contents

DECEMBER 1948

VOLUME 13
NUMBER 6

Forum 3
Grinding Leaves ..... J. I. Rodale 12
Minerals and Trace Elements ..... Leonard Wickenden 16
Sweet Pea for 1949 21
Perennial Garden Phlox ..... E. I. Wilde 22
Botany for the Gardener (13) ..... Dr. William H. Eyster 26
Plan Ahead When You Buy Nursery Stock ....John Shrager 30
One Man's Garden ..... Avery Nelson 35
Earthworms—Living Subsoilers and Composters Dr. William H. Eyster 37
Health and Humus ..... Roger W. Smith 41
His Excellency—The American Bluebird ..... Carl M. Sisk 46
Soil and Health Foundation 49
Garden Calendar—December 50
Book Review 53
Compost Clinic 54
Compost Correspondence 56
Readers' Correspondence 58
Index—July to December, 1948 62

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ORGANI-CULTURE

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YOU CAN'T SPRAY AND HAVE EARTHWORMS

October 1, 1948.

Dear Sirs:

After a lecture given by Dr. J. H. Gourley to the annual Convention of the Northern Nut Growers Association, we visited the test plots of apple trees and saw organic matter from 12 to 14 inches deep that reached out to the tree's drip line.

This organic matter was moist, pitch black and would run through your fingers. On packing one could easily form a ball. The weather was very warm and had been for quite a spell giving me the impression that all soil would be dry. This was not the case with this organic matter under these apple trees.

I have dug up a number of trees in my time but never have I seen such an enormous root system of fibrous roots running throughout this organic matter. At no place in this root system could one pass an object as big as a baseball without touching a root. All these roots were about the size of grocery string.

What would happen to a root system like this should one attempt clean cultivation with disk or spring tooth harrow is quite obvious.

These trees had been mulched for 35 years Dr. Gourley told us.

Enthusiastic Dr. Gourley thought this an ideal situation by exclaiming, "Isn't this wonderful organic matter?" as he caressingly held up a handful.

"No", I replied, "where are your earthworms?"

He then replied, "You can't spray and have earthworms."

This gave me something to think about. I thought then, why not stop spraying and plant earthworms just

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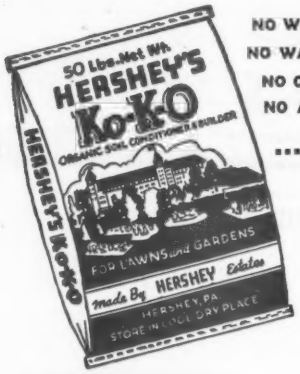

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like Herbert Clarence White is now doing in his "Crazy Man's Orchard".

Dr. Gourley told us that wheat straw was used for mulching because of the high potash content. The potash entered the soil by leaching. The wheat straw was spread to the drip line of each tree at the rate of 200 pounds per year.

I have now come to the conclusion that the same method is sod-mulch-earthworm cultivation for trees. Rebuild the forest floor as nature intended.

I brought up the question of earthworms with Dr. Colby of the Horticultural Department of the University of Illinois, and he said, "I would like to see the earthworm prevent red leaf and leaf curl in strawberries."

Being at Wooster at the time and on vacation, I went to the Ohio Earthworm Farm at Worthington, Ohio and saw the healthiest, deepest green, massive leaved strawberry plants in early September, 1946. I saw no leaf curl and no red leaf among these plants.

Edwin W. Lemke,
Camp Ground Road,
Washington, Michigan.

—o—

OLD-FASHIONED GARDENING

August 17, 1948.

Gentlemen:

I just can't begin to tell all the wonderful things compost and the right gardening has done for all my flowers and vegetables this season, before I have constantly fought bugs and diseases and then watched so many of the vines die. This year all the beans and cucumbers and melons are so thrifty. I have constantly carried home "bug and disease killers" along with commercial fertilizers from the store as I am a bookkeeper in a hardware store where we carry all these things, I got them at a discount and so did not spare in the amount of either used. I became alarmed when I discovered dead earthworms under a hot cap I had put on some cabbage after planting and sprinkling or doping

Sir Albert Howard's Books

AN AGRICULTURAL TESTAMENT

by Sir Albert Howard, C.I.E.

Louis Bromfield has said of this book that it is "the best book I know on the soil and the processes that take part in it." Written by an expert scientist, the developer of Organic Gardening procedures, THE AGRICULTURAL TESTAMENT is a classic. Loved the world over for his combination of practicality and humility, Sir Albert Howard so bound himself up with Nature and its wonders that his approach to farming often verged on the mystical. But he was withal as down-to-earth as any farmer could wish. In other words, he was a genius, and the AGRICULTURAL TESTAMENT is a work of genius. Used as a text-book it will safely and surely bridge the gap for the novice between the use of harmful chemical fertilizers and organic methods, utilizing Nature's own laws and rhythms. Cloth. 253 pp **$3.50**

THE SOIL AND HEALTH

by Sir Albert Howard, C.I.E.

Food problems have their beginnings as soil problems, and can only be solved by an understanding of soil fertility. Sterile soil cannot produce food, and man cannot exist without being fed. So it is essential for mankind to learn how to maintain fertility and to learn how to re-create it when it has been destroyed. Everything civilization has accomplished so far has been based upon exploitation, first of the earth itself and then of its peoples. Industry and trade have had a way, all too often, of developing into banditry. Sir Albert Howard thought so, and while he was no Jeremiah, he did see clearly that mankind was poised on the verge of failure. He proved his theories, because he was not only a scientist but a practical farmer. This book deals specifically with crops and livestock, includes an illuminating history of agriculture and ends with a list of farming practices to be avoided. Cloth. 320 pp. **$4.00**

THE EARTH'S GREEN CARPET

by Louise E. Howard

Lady Howard is the widow of Sir Albert Howard, the founder of the Organic Farming movement. She has made herself an authority on agricultural problems and tells in this book of her theory that degenerative diseases are on the increase all over the world due to our shot-in-the-arm chemical fertilizing methods of growing the food we eat. Naturally, she advocates the adoption of Sir Albert Howard's theories and stresses the fact that Man's health and happiness depend upon the use he makes of THE EARTH'S GREEN CARPET. The book is vividly written, and the scramble for life of all growing things is graphically set forth. Nature holds everything in place if Man permits her to, but when his depredations are successful the precious top-soil is lost and blows across the land or washes downstream. Lady Howard warns us that it is almost too late, and if we do not change our methods Man can easily vanish from the face of the earth. A Rodale Press book. Cloth. 260 pp. **$3.00**

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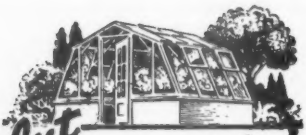

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generously with a very good commercial fertilizer we carried. I didn't use any more of that but was worried what to do as I knew the soil had to have something. Then my mother heard a lecture by Mr. White and told me of it. I was ready to do any of the things that the Organic Gardening magazine she brought me suggested, althought I was a little skeptical I followed instructions to the letter. I have found all of it more than right. Right now we have three compost piles in different stages and will have plenty for the three acres we work. Every idea I read about that I have tried, has proved so very true. When I think back to the way my father farmed, I know now why he never used any commercial fertilizer, always let his farm manure break down before spreading. He mixed with lime, etc. Perhaps he couldn't explain in the way Organic Gardening does all the "Why" of things, but the "old-fashioned" way as he called it was the right way and good enough for him. I know why he was a good farmer and always built up any land he was working.

This has been a long letter and no doubt of no interest, for you have so many of them, but it is all so very true and I am so thrilled to do things the right way and achieve successful results immediately. I knew the right way, but it is so easy to get away from it, but the effort to do right has well repaid itself. I am more than ready to explain and talk it to everyone who will stop to listen.

Flo Wimmermark,
R. 1, Box 556, N. Wattles Rd.,
Battle Creek, Michigan.

—o—

WHAT FRUITS AND FLOWERS!

July 26, 1948.

Dear Sirs:

Just one year ago this July we got our first issue of Organic Gardening. We started our compost *at once*. We usually have about 150 hens and had been spreading the droppings uncomposted—but no more.

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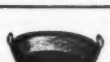

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BLOOM MAGIC LAB., BRIDGETON 14, INDIANA

First we started our pits, then we got our garden record book started so there would be no guess work. We had a cherry tree that each year was loaded with blooms and cherries would set but for the whole life of the tree (about fifteen years) we never had a cherry mature. We piled up the leaves under it last fall and put on rocks over that. Our compost was not made yet so had none of that. This year we have as good a crop of cherries as other people as it was a poor spring for cherries. Our apricot had been given up by the experts but it is loaded and healthy looking after the same treatment. Our peach got the short end. Late in the fall we put three loads (wheel barrow) of sods around it was all but we had no leaf curl.

In the spring we had a light sprinkling of compost and spread it all over our garden. We had planted a winter cover of rye and had the rototiller over it all.

Our ground is heavy clay and always cracked open and was more like cement than soil and the aphids always got more of the garden than we did. When things began to mature we first noticed the richness of the pansies. We never have had such a garden and the soil is loose and easy to work.

We used no spray of any sort and have had no pests. The white butterflies come but they don't light.

I dug around my rose bushes and put in compost in the earth and mulched with alder sawdust. Such a nice healthy clean growth.

One morning, I found the buds covered with aphids. Well, I decided it was a good try, but didn't work. Next day the aphids were gone and have never returned. This spring we made big compost pits of planks 3 x 12 and dug down into the ground about a foot. Went outside and brought in nettles and dandelions when they were real rank and I will have plenty compost next year.

I just can't vision what my garden will be when I have plenty of it. We can't thank you enough for starting

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FARMERS OF FORTY CENTURIES

by F. H. KING, D.Sc.

formerly Professor of Agricultural Physics, University of Wisconsin; and Chief of Division of Soil Management, U. S. Dept. of Agriculture

Preface by DR. LIBERTY HYDE BAILEY

AN agriculture is permanent only to the extent that we return to the soil sufficient organic matter to maintain the soil in a living condition; for only a living soil can be permanent and productive. Dr. King takes his readers into the fields of Japan and China to observe at first hand the agricultural practices which enabled those peoples to maintain their soils in a highly productive condition over the centuries. They convert all plant and animal residues into compost as food for the soil organisms. There is neither erosion nor depletion of soils, neither deficiency nor biological diseases of any consequence in their crop plants, and no "running out" of crop plants. In this book we may find answers to our own agricultural problems. Cloth. 384 pp., 209 illustrations from photographs. **$5.00**

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by M. C. RAYNER, D.Sc.

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us on this. We read everything we can get pertaining to this and find it intensely interesting.

Vera V. Warner,
805 E. 2nd St.,
Port Angeles, Washington.

—o—

COMPOST KEEPS FLOWERS HEALTHY

September 18, 1948.

Gentlemen:

Had my first experience with compost last year. One of my neighbors remarked to me one day that "Come spring you will have to hire a truck to haul away that pile of stuff you have in your back yard." Not having had any experience, I didn't know but what I would have to follow his suggestion. However, when I opened the pile, it contained the richest and sweetest smelling black compost I had ever seen. (Incidentally, my neighbor didn't hesitate to take some five or six bushels of the compost when I offered it to him.)

One experience clinches your claims: We had some flowers and each year they would come up but by the time they were ready to bloom they seemed to wither, curl up, and turn brown. I used fertilizer and poison spray but seemingly that did no good. I gave the compost a try, used it freely, and worked it well into the soil. This year there was no sign of withering or curling of the plants. They are a deep green color, and the blooms are very fine indeed.

Roy M. Miller,
4235 Waverly Ave.,
Detroit 4, Michigan.

—o—

EARTHWORM COMPOST INSURES PRIZES

September 26, 1948.

Gentlemen:

On May 30th, 1947, after quite a period of study of the subject, my wife and I and two friends set up the "Chardon Earthworm Farm" with the object of not only raising earthworms, but of demonstrating their efficacy on

an experimental farm. In September of that year, we were forced to move, so I returned to my original farm where I built a house on four acres of land that I had reserved and this past Spring we were able to start from scratch.

In August, 1947, having been in business only three months, we exhibited at the local fair in Burton, Ohio, showing in addition to the worms and castings, three controlled plant experiments—cabbage, strawberries and African violets, all plants being from the same original stock, one set being treated with worms or castings and the "control" plants raised in just ordinary good soil. In all three cases, the superiority of the treated plant so surpassed the "control" plant as to excite much interested comment from visitors to the fair.

This year, landscaping was begun at the new house, a larger garden was planted and beginnings made on a small orchard of dwarf fruit trees while "control" experiments were also carried on. At the Burton Fair this year an exhibit of 25 garden products brought us first prize with ease. We are personally convinced of the value of the earthworm in agriculture.

Will Scovill,
Chardon, Ohio.

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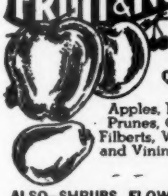

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Grinding Leaves

THE age-old method of using leaves as a fertilizer was to make leaf-mould out of them by stacking them in heaps and allowing them to decay for a period of about two years. A few years ago I experimented with the grinding up of leaves in a hammermill and ground the leaves up so fine, in an instantaneous process that they could safely be used as an organic fertilizer to be applied at once to the soil. What had once taken two years could now be done in two minutes. Of course, a hammermill costs a few hundred dollars so that this method would be practical only for nurserymen and large estates. The idea to grind up leaves came about in a peculiar manner. I had taken off my book-shelves an old book and was going over it when a page fell out, and in handling it, it began to crumble. I carefully replaced it and put it back on the shelf.

That evening, while seated at the supper table, I saw the leaves falling, floating downward slowly in all their beautiful colors. Suddenly I remembered the old page of the book that had crumbled. I quickly went to the shelves and removed that page. Without thinking of the value of the book I took that sheet and crumbled it to bits with my hands. It had become so dry and crisp with age that it was broken into a thousand tiny fragments. I could hardly wait until next morning to gather some leaves and see how quickly they could be dried. It was a simple matter, but my farmer was more anxious even than I and he began to run them through the hammermill before they were thoroughly dry. But he was a smart farmer. When he found that due to their moisture content they gave him trouble, he mixed dry straw with them and they ground up beautifully. They turned into what seemed like nice brown earth. (See Fig. 1.) This seemed too good to be true. A hammermill is standard equipment on the average-sized farm and is used to grind up wheat, corn and other materials for feeding to the stock. However, since the average gardener would not want to invest in such an expensive piece of equipment, I began to search for a simpler method and have developed one this autumn. It is so simple and inexpensive that it can be performed economically by a person having only a small lawn to take care of or a few flower beds or a vegetable patch.

In this method it is of the utmost importance that the leaves be thoroughly dry. They must be gathered and stored in a place under cover. In a cellar they will dry sufficiently in about two days. To test whether the leaves are ready, crumble a few of them by hand. If they crumble nicely you are ready to begin. Incidentally it is surprising how easy it is to crumble goodly quantities of leaves with the hands, without the aid of any equipment whatever. By wearing gloves greater pressure can be applied. If your requirements are not too great, try it first by hand and see how fine

Hammermill

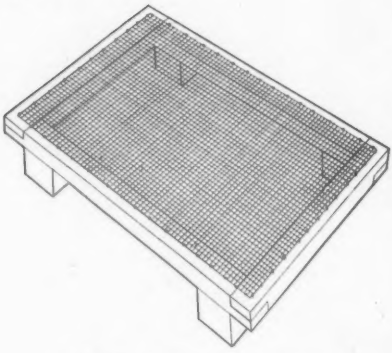
you can disintegrate the dry leaves. Perhaps you will not have to go to the trouble of making the screens that will now be described. In this hand crumbling you might be able to further reduce the size of the particles by putting them through a sieve which is almost always found in any kitchen.

Put the material in the sieve and apply a kneading motion. You will see how easy it is to force the material through.

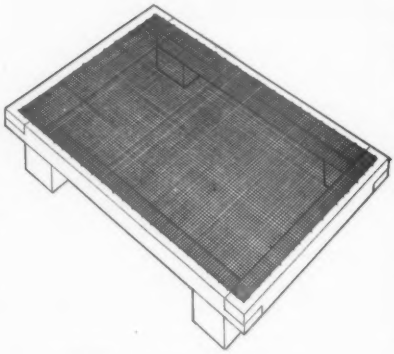
As I have stated above it is of the utmost importance to let the leaves dry thoroughly. Perhaps, to be sure, you can let them dry for an extra day or two. You are now ready. Make a screen in a frame approximately two by three feet as shown in Fig. 2, using ½ inch screen wire sold in any hardware store. Its trade name is hardware cloth, ½" size. The first operation is

Fig. 1

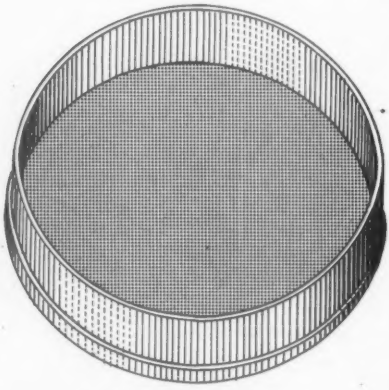
Fig. 2



½" Hardware Cloth Screen



¼" Hardware Cloth Screen



Bakers Flour Sieve

to force the leaves through this screen. You then screen this product through your second frame which is made with a ¼" size screen, so that the product comes out a little finer. You will find it more difficult to procure the ⅛" screening for the last frame, so a household flour sieve can be used. You can make a fourth screen out of mosquito wire screening if you want the product to be extra fine. It is suggested that gloves be worn for ease of working the material through. There are variations to this equipment which the intelligent gardener can think up to suit his own situation, and the equipment is most inexpensive.

If it is desired to get the leaf particles even still finer, it can be put through a household coffee grinder, or a hand grain grinder that can be purchased for perhaps five or six dollars from Sears Roebuck, or Montgomery-Ward. They also handle a cheaper, smaller model hammermill that sells for about sixty dollars, without motor. Fig. 3 shows the material of the three grades of fineness, as coming from the ½", the ¼" and the ⅛" screens.

The question arises what to do with this ground-up leaf. You can sprinkle it over your lawn, or work it in immediately in the top few inches of your vegetable garden. You can mix it with sand, soil and compost in seed-flats and let it season in your cellar over the winter for starting your vegetable seedlings next spring. It can be worked into flower and shrubbery beds. It can also be stored in the cellar over winter, mixed with a little topsoil and watered regularly to turn into finished compost by spring. If ground fine in a coffee grinder it can be used for flower pot plants. If coarser it can be used for a mulch in a flower pot. It makes an ideal food for earthworms, for those who are raising earthworms, as the worms are extremely fond of leaves and consume this finely ground up material in a short time.

In this process the stems do not become pulverized but will disintegrate rapidly in the soil; but should be picked out where it is to be used in

flower pots. Remember, that leaves are one of the finest fertilizer materials because the roots of the tree go down to depths of twenty-five feet or more and bring up the inexhausted minerals found there. Leaves are rich not only in nitrogen, phosphorus and potash, but in the dozen or more rarer elements that are so essential to the welfare of plants.

J. I. RODALE.

Fig. 3

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By LEONARD WICKENDEN

MINERALS AND TRACE ELEMENTS — *from a forthcoming book*

WE are often told that, while organic fertilizers undoubtedly improve the texture of the soil and supply a certain amount of nitrogen, their mineral content is so low as to be entirely inadequate. This is the favorite argument of those who have reached the half-way house of using compost and animal manures in combination with chemical fertilizers. Their point of view is one which we cannot afford to ignore. It is worthy of respect and entitled to close examination. In this chapter, let us make an effort to get our minds clear on the subject.

In talking to fellow gardeners who habitually use commercial fertilizers I find they have usually formed a definite picture of what they think happens when they scatter a fertilizer alongside their rows of seedlings. Following the application they usually put in a little work with the rake or cultivator and then hope for a shower of rain. If rain does not come, they sprinkle the soil with a watering can or the garden hose. The fertilizer, they assume, dissolves and soaks into the soil, the roots of their plants grope around eagerly, each one takes a drink of sulphate of ammonia or muriate of potash or whatever it may have been offered, immediately feels tremendously pepped up and grows another couple of inches. This picture is very clear and delightful in its simplicity. Unfortunately, it is quite wrong.

To explain what actually happens (or what those who have studied the subject think happens) it is necessary to make a brief excursion into chemistry. To anyone who has taken a course in high-school chemistry, this need not be in the least alarming, but I want to be honest with those who haven't and tell them that we are going to talk about *colloids* and *dissociation* and *ions*. If they want to skip this chapter, that is their privilege, but I hope they will stay with us for I am sure they will not find the excursion fraught with much mental danger and it may provide them with one or two additional reasons for avoiding the direct addition of chemicals to their soil.

To make our discussion as simple as possible, let us consider one common fertilizer—muriate of potash. The chemist calls it potassium chloride because it is made up of the two elements potassium and chlorine. The two have a great attraction for one another, because one (potassium) has a positive charge while the other (chlorine) has a negative. They are, so to speak, of different sexes and have married to form the compound potassium chloride. As long as they remain in crystal form the atoms are locked in one another's arms in an almost unbreakable bond. They are imprisoned in crystal walls. But put them in water, dissolve the crystal, and the bond at once becomes very loose.

In chemical parlance, they dissociate —a term which has always had, for me, rather tragic overtones. Do not suppose that your solution now consists of atoms of potassium and atoms of chlorine swimming around in water; that would be quite impossible, for potassium is a metal which reacts with water in a violent manner, while chlorine, as everyone knows, is a green and evil smelling gas. It is the ions of which the molecule is built that are

now partly free—not entirely so, for the potassium ions, with their positive charge and the chlorine ions with their negative charge are still quite attractive to one another. If someone will evaporate the water down to low bulk, crystals will form again and the marriage will be saved. But left in solution, the ions of each element are eagerly on the lookout for new partners.

It is the job of the soil to provide the plant with the food it needs and the plant does not want chlorine ions nearly as much as it wants potassium ions. So the soil gets to work on these young couples and sets about making their divorce complete. The soil contains colloids. You can find a definition of a colloid in almost any book on chemistry but the definitions contain so many words with which the average man is even less familiar than he is with the word *colloid* itself that they do not help very much. Without going too deeply into the matter, let us say that a colloid is a state of matter intermediate between a suspension and a solution. The particles of a colloid are so small that they will stay in suspension indefinitely and will pass through an ordinary filter paper. Because they are so small, a given weight of them will present a tremendous surface, since every time you break a particle of matter into smaller pieces, you open up new surfaces. The two substances which are most commonly in colloidal condition in soil are clay and humus. We will consider clay, partly because it is simpler and partly because the habitual user of chemical fertilizers is likely to have considerably more clay in his soil than humus.

Another characteristic of colloids is that they have either a positive or negative charge. Clay is built up of minute plates, the inner layer of which consists of negatively charged ions. Because of this negative charge, they have attracted to themselves a mixture of positively charged ions, of which calcium is usually the commonest, but hydrogen, and potassium, magnesium, sodium, iron, aluminum and other metals are often present. These form the outer layer. Here you have a sort of earthy polygamy, in which the clay particle, because of its irresistible negative charge, has collected to itself a large harem of positive ions of hydrogen and various metals. Because the minute clay particles have so much surface, their capacity for attracting positive particles is very great.

It is from the colloids of clay and humus that the plants obtain their food. Left to nature and with a supply of organic nutrients available, the colloids will maintain a healthy balance of available foodstuffs—or, in other words, a satisfactory mixture of metallic ions. But what happens when the solution of potassium chloride suddenly permeates the soil? It amounts to an invasion of an enormous army of potassium and chlorine ions. The potassium ions, with their positive charge, approach the particle of clay with its swarm of negative charges, there is mutual attraction, and because the concentration of potassium ions is so high they overwhelm the clay's harem, turn out the collection of assorted wives, and now present to the plant a meal which is overstocked with potassium but woefully weak in the other elements which the plant needs for its growth and health. The plant will go on a potassium binge and then, as so often happens with us humans, it faces the morning after the night before. It doesn't feel so good.

In the meantime, what has happened to the deserted negative partners, the chlorine ions? The plant is very little interested in them and the clay, having a negative charge itself, is not interested at all. But every positive ion of the harem, thrown out by the potassium, is looking for a new partner. So it rushes into the arms of a chlorine ion, resulting in the formation of chlorides in the soil. Every time the gardener adds muriate of potash, he builds up the chloride content of his soil, and there is general agreement that chloride-rich soils are not desirable.

Similar difficulties occur with other chemical fertilizers. When sulphate of ammonia is used, it is the ammonia which is absorbed by the plant, leaving

the sulphate radicle free to link up with hydrogen and form sulphuric acid. If you try to escape from this dilemma by using nitrate of soda to supply your nitrogen, it is the sodium which the plant rejects and, hunting around for a partner, as always, the sodium links up with carbon dioxide in the soil, forming sodium carbonate, which is washing soda. Would any gardener knowingly add washing soda to his soil?

What is the answer of the organiculturist to these dilemmas? His plants need mineral matter for their health and growth. Can he supply it without using chemicals?

If we may desert chemistry for a few paragraphs and use a little elementary arithmetic, let us consider some figures. Once again, for the sake of simplicity, we will first consider the problem of supplying the soil with potassium, and we will assume that a crop of corn has recently been taken off the land under consideration. It has been estimated by A. C. Britton, statistician of the U.S.D.A., that the average amount of potash (K_2O) taken from an acre of land by an average crop of corn, is 9.4 lb. Let us call it 10 lb. in round figures.

After we have garnered our harvest of corn, we want to replace the potash we have lost and add something extra for good measure. Suppose we want to do this with mixed farm manure; how much would we have to spread?

Because farm manure varies considerably in character and composition, it is not easy to quote an exact figure for the potash content of manure. However, we will take the figure given by Lyon and Buckman in their book *The Nature and Properties of Soils,* which is a standard work on the subject. They give the average figure as 0.5%.

We need 10 lb. potash for replacement; this would obviously be provided by 2000 lb. of manure. By spreading 4000 lb., we put back twice what we took out. But 4000 lb. is only 2 tons and the addition of 2 tons manure to the acre is no large amount. To maintain, or, better still, to increase the organic content of the soil, as much as 10 tons is often used and sometimes even that figure is exceeded. 10 tons manure would supply 100 lb. potash and to obtain the same amount from a 5-10-5 chemical fertilizer would require a ton—a considerably larger quantity than is normally used.

As far as potash is concerned, therefore, normal amounts of mixed manure or compost will supply all that is needed and more. The same is true of nitrogen. Ten tons of manure, or compost, will supply as much nitrogen as a ton of 5-10-5 fertilizer. When it comes to phosphates, ten tons of manure will supply only about as much as 500 lb. of 5-10-5 fertilizer—which is about the quantity commonly used.

This, however, is not the whole story. The subsoil is mainly mineral matter and contains a great variety of elements. In most cases, it can be considered an almost inexhaustible source of minerals, but these minerals are useless unless they are available to the plants we want to grow. Can they be made available? Indeed they can if we farm in harmony with nature instead of fighting her.

It has been estimated by E. J. Russell that the addition of manure to the soil will raise the earthworm population from 13,000 to over 1,000,000 per acre. This enormous increase will have a great effect on the problem of mineral supply. Darwin found that earthworms burrow to a depth of 8 feet or more, and as they burrow they fill their bodies with soil and then make their way to the surface and eject it. In other words, they are continually mining the subsoil and bringing to the topsoil the mineral wealth they find there. The figures quoted by Darwin are almost incredibly high. He states that their castings, in the course of a year, would form a layer as much as one-fifth of an inch thick and weigh 15 tons to the acre. In face of such figures as these, the sprinkling of 500 lb. fertilizer seems insignificant.

This added fertility is a bonus given by nature only when earthworms are encouraged by the plentiful addition

of organic matter. Chemical fertilizers result in no such bonus. On the contrary, countless witnesses testify that the steady addition of chemicals reduces the earthworm population. "Earthworms", say Lyon and Buckman, (who, by the way, strongly advocate the use of chemicals) "must have organic matter and thrive best in land where this constituent is plentiful."

It must not be forgotten that the mineral matter ejected by earthworms is rendered available by the digestive juices in the worm's intestines. To quote Lyon and Buckman once again: "The rank growth of grass around earthworm casts suggests an increased availability of plant nutriments."

A further source of mineral enrichment of the top soil is provided by plants themselves, which bring quantities of minerals from the subsoil. There is widespread belief that roots of plants find all their nourishment in the top six inches, or so, of the soil. This is far from the truth. Weaver and Bruner in their book *Root Development of Vegetable Crops* (McGraw-Hill) report that common vegetables have roots which pentrate to depths ranging from five to fourteen feet. One of the bad features of chemical fertilizers is that they supply "easily available" food in the top few inches of the soil, thereby encouraging the roots to stay near the surface instead of searching for it at lower levels. This renders the plants more easily affected by drought and floods, while the mine of minerals far below the surface tends to become neglected.

If plants are left to forage for their own food, they will bring up from this almost inexhaustible mine such minerals as they need. Since in almost all plants a large part is waste, if this waste is added to the compost heap or to the manure pile and later to the soil, the topsoil is receiving a steady supply of all kinds of mineral matter, including trace elements, from this source. If the farmer or gardener grows a cover crop of deep-rooting plants and ploughs the crop under, all the minerals brought from the subsoil are distributed through the topsoil.

Much has been written in recent years about plant diseases caused by deficiency of trace elements, such as boron, manganese, copper, zinc, molybdenum, cobalt, iodine and so forth. It is suggested that these trace elements should be added in the form of chemical fertilizers. The difficulties in the way of carrying out such a proposal would seem almost insurmountable for the average gardener or farmer. One basic difficulty is that while a deficiency of these elements may lead to disease, an excess may prove fatal. Is it practicable for any ordinary man to determine just what quantity his land needs and then add it in sufficient and yet safe amounts?

Dr. W. G. Ogg, Director of the famous Rothamsted Experimental Station, in a recent address before the British Association (Dundee, August, 1947) when speaking of the ill effects which follow a deficiency of these elements, adds these words:

"Excess of soluble manganese is highly toxic to plants."

"Excess of molybdenum is harmful."

"Another excess which can give rise to a disease is that of selenium."

Is it reasonable to suppose that every farm and garden can be turned into a chemical laboratory in which the feeding of these trace elements can be so carefully controlled that the plant always gets sufficient but never too much?

It is only in recent years that this matter of trace elements has arisen. For untold generations man has been growing his crops, never knowing they existed, and with far less trouble from diseases than the farmer is facing today. In many parts of the world, healthy and luxuriant crops are still being raised with never a thought given to the need of adding trace elements. On the very land in which the agronomist now finds that plants are sickening because of an alleged deficiency of one trace element or another, weeds are growing with no sign of such deficiency. Commenting on this fact,

Patrick J. McKenna writes in *Countrybook* (Fall, 1947, p. 25) "The astounding thing has been that weeds growing in these soils showed no deficiency of the same mineral elements. . . . It might suggest that our major economic crop plants have lost the faculty of extracting the needed elements from the soil particles. Don't forget that plants have the faculty of adaptation, and that we have been applying readily available food nutrients to the soil and crops for generations."

These significant words from Mr. McKenna, who is Assistant Horticulturist of the New York Botanical Gardens and a member of the faculty of Hunter College, drive us back once more to the view that in almost all soils which have the right to be cultivated at all, Nature will provide all the minerals needed if we do not thwart her by trying to outsmart her. The real problem which the farmer must face and solve is that of maintaining the organic content of his soil. If he does that, the problem of supplying sufficient minerals will be solved along with it. This subject, and the problem of dealing with the special case of a soil which is fundamentally deficient in minerals, are discussed further in Chapter 14.

LIFE SUBSCRIPTIONS

ORGANIC GARDENING MAGAZINE has decided to have a standing offer of life subscriptions at a price of $35.00 which is today's price of an ounce of gold. For the equivalent of an ounce of gold you will receive the magazine for the rest of your life, regardless of your age. You will thus be relieved of the detail work of renewing from year to year.

For those who desire to make payment over a period of one year, send $5.00 and we will bill you for $5.00 every two months, until a total of $35.00 is paid.

J. I. Rodale

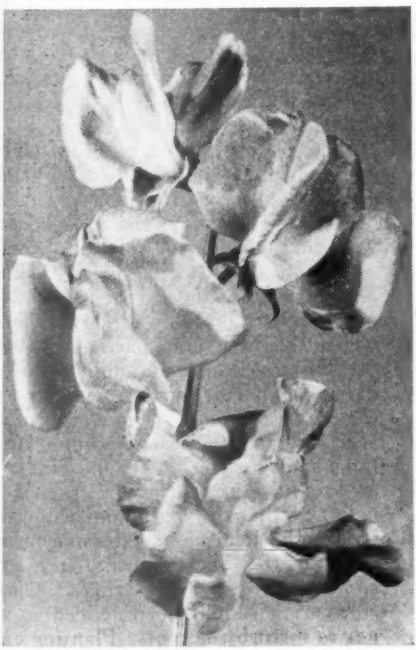
ORGANIC GARDENING EMMAUS, PA.

New!

Sweet Pea for 1949

NEW sweet pea for 1949 is the "Margaret O'Brien," which David Burpee has named for the little motion picture star whose latest film, still in production, is "Little Women."

Winner of the Gold Medal of the world-famous Scottish National Sweet Pea Society, the new flower is described as salmon-coral suffused with a luminous orange. In sunlight, the salmon-coral tones are predominant; indoors, under artificial light, the orange tones are accentuated.



The Margaret O'Brien Sweet Pea is adapted for growing in home gardens and is of the Giant Spencer type. Stems are long and sturdy and the foliage is a mid-green color. The plants are vigorous and blossom profusely.

The new flower was developed from a cross between an early blooming variety of sweet pea used for greenhouse culture and a summer-flowering giant seedling. The cross was made in 1939 and selections were made each year until the stock was breeding true. In 1947, there was enough of the seed to enter it in the Scottish National Sweet Pea Trials. In this international competition of sweet peas judged during trial growings and a subsequent show held in Glasgow, the new sweet pea won the Society's highest award.

Phlox Drummondi

Perennial Garden Phlox

By E. I. WILDE

TWO hundred years ago, two native Pennsylvania phlox varieties, *paniculata* and *maculata,* believed to be the progenitors of our modern summer perennial varieties, with their pink-purple small flowers were considered very beautiful. Today, modern varieties, which appear as the result of hybridizing, have an intensity of color as far removed from the native plants as are the rays of the sun from the soft glow of the moon. Usually the various colors are attractively displayed in compact, dome shape, hydrangea-like flower clusters at the season of the year when most other perennials have completed their flowering period and before many of the annuals have reached their height. However, the flower cluster of Miss Lingard, which is considered an offspring of *P. glaberrima* var., *suffruticosa,* is columnal and it is the only one considered good for cutting. The phlox, therefore, is primarily a garden display plant.

Culture

Phlox is not difficult to grow but it does appreciate a rich and well drained soil, similar to one for good vegetable production. It enjoys the full sunlight yet a little shade, when the sun blazes, is beneficial. It will tolerate close planting although a spacing of 2-3 feet is most favorable. It also enjoys plenty of moisture, particularly, at the flowering season and unfortunately nature does not furnish enough for the shallow roots. Therefore, it is necessary to supplement normal rainfall but in doing so, care must be exercised to apply the water in such a manner that a minimum amount strikes the foliage for excessive moisture on the foliage encourages leaf spot. Also remember that shallow cultivation should be practiced so as not to disturb the roots. Planting can

be done at almost any season of the year if care is used, but September is considered the best, for then there remains sufficient growing period during which the plants become established before the soil freezes. If the fall growing season is short, spring is preferred.

The phlox is generally sturdy and vigorous and the longevity of a plant is limited only by its vigor, the fertility of the soil, and the competition of other plants for food and moisture. Renovate plantings only when plants lose vigor and intensity of color. This should not be necessary more frequently than two to four years. In fact, most varieties are at their best during the second, third and fourth years.

Propagation

The common method of perpetuating a planting is by division of the clumps. They should be lifted and the soil shaken out as much as possible. Then the clumps can be pulled apart and each stem with its root system and cluster of buds at the crown becomes a potential new clump. These divisions are planted 18 to 36 inches apart, depending upon the vigor of the variety and the length of time they will occupy the space. For more immediate effects, a clump may be divided into segments containing three to five stems rather than just one. A wide, shallow hole 5 inches deep is best for setting plants. The roots are spread out carefully and the crown of the plant (basal buds) covered by not more than 1 inch of soil. Thoroughly firm the soil and then water. After the water settles into the soil, the plant should be mulched. This is to remain on during the fall, winter and until the plant is in vigorous growth in the spring.

A more rapid method of increase is by root cuttings. These are made as follows: in the fall, after bloom has ceased, lift the entire clump; cut off the heaviest roots to within 2 or 3 inches of the crown and cut these roots into 2 or 3 inch lengths. Scatter the cuttings in a well prepared bed

Cuspidata

and cover with an inch of sand. Mulch lightly for the winter. In the spring, the cuttings will send up slender growths after remaining dormant all winter.

Varieties

There never will be a unanimous choice of the best varieties among gardeners because of the individual color preference. Although the range and purity of color has improved in recent years, some are still muddy and all fade in the sunlight, some to a greater degree than others. The flower clusters, which are usually compact with flat, rounded, pyramidal, columnal or diamond-shapes, are displayed on plants ranging from 18 inches to 3 feet. Several of the varieties have the excellent habit of sending out lateral flowering branches which helps immensely in extending the normal flowering period. The size of the florets varies from 1 inch for Miss Lingard to 1½ inches for most of the newer varieties. The flowering season starts about the middle of June with Miss Lingard and finishes the first of August with Mary Louise. The varieties suggested below have proved their worth in the Test Gardens of The Pennsylvania State College, in a Hagerstown soil and at an elevation of 1205 feet.

Whites are always desirable for buffering the clashing colors of red, salmon and so-called blue phlox. *Mary Louise* is the most outstanding white *Louise* is the most outstanding white with its immense mounds of large dwarf and its smaller flowers are produced in great abundance. *Miss Lingard* is included because it is still a good white in the garden and for cutting and it does help to extend the flowering season of this group.

The near whites, so called because the soft tints fade to almost white, would include *Painted Lady* with its small light pink flowers with a red eye and *Atlanta* with its enormous clusters of light lavender flowers with bluish eyes. *Count Zeppelin,* an old timer, is a tall vigorous variety with an abundance of medium-sized white florets with a bluish eye.

For restful plantings use light pinks. *Apple Blossom* with its deeper eyes and a color indicated by its name is lovely. *Daily Sketch,* a rose pink with a red eye and fine foliage is now an old favorite and needs no further introduction. *E. I. Farrington* is a rose color with a wide light zone blotched with red. Its florets are large and in compact clusters. *George Stipp* is a trifle deeper in color but with a less compact cluster. All of these pink varieties are vigorous growers and very effective.

The deeper salmon colors are excellent for dazzling focal plantings. The two outstanding varieties in this class are *Salmon Beauty,* a medium tall variety with florets with nearly white zones and the taller *Eva Foerster* which is similar in color but with purplish blotches at the eye. Both bear large clusters and large florets.

There is a great range in hues among reds and much duplication of color in varieties but the following varieties are sufficiently different to be represented in any garden. *Bright Eyes,* a comparatively new comer, is the reddest of the dark-eyed varieties. *Charles Curtis* offers a dazzling display of clear, bright scarlet florets with lighter centers which is equalled by *Harvest Fire* with its tantalizing orange-red florets. *Augusta,* with its cherry-red florets and deeper centers is not radiant but its color display and habit of growth are excellent. *American Beauty* is suggested for those who are fond of the rose by that name. Then there are two old timers, *Leo Schlageter* with its early display of scarlet-red and *San Antonio,* which is tops among the blood reds.

The shadow colors (lavender, violet and purple) are inclined to be muddy and do fade badly. *Fairy King* is an excellent soft lavender with good foliage and round clusters, while *Mikado* of medium height is a deep violet with a striking white eye. Two varieties which have very clear colors, while in fading remain pleasing, are *Katherine,* a clear lilac and *Ethel Prichard,* a clear violet with a pinkish center. A much advertised blue

variety, *Progress*, is truly a violet with a reddish eye. The color is muddy and fades badly but in spite of this, the color is different and appeals to many.

Diseases

The loss of the lower leaves on phlox frequently destroys its display value and naturally reduces its vigor. The cause may be attributed to mildew, leaf spot or blight, and occurs when the plants are grown in improperly conditioned soil.

Mildew is distinguished by grayish-white powdery growth on both surfaces of the leaf. It is most frequent on older leaves and on crowded plants.

Leaf Spot is identified by brown spots on the foliage, especially the lower leaves. It causes the leaves to wither and die.

Leaf Blight. So far as known this is not a disease. It is characterized by the dying of the lower leaves and the progressive death of the leaves up the stem sometimes killing the entire shoot. It is more than likely that this condition is caused by the deficiency of one or more elements in the soil.

Pests

Red spiders are often very destructive. They frequently injure the buds and cause the blotching of color which definitely spoils the display value. They are partially checked by spraying with water under pressure.

A stem-inhabiting species of nematode causes stunted, swollen and cracked stems; narrow, distorted and crinkled leaves, and an overabundance of basal buds. Flowering is inhibited entirely in severely infected plants. As a rule nematodes do not occur in numbers sufficient to do damage to plants in soil that is in good tilth.

EARTHWORM GROWERS CONFER . . . . . .

Mr. L. C. Lemmon, who owns and operates the Capital Earthworm Farm in Arlington, Virginia, was a recent visitor at the Ohio Earthworm Farm in Worthington, Ohio. His hostess was Miss Bernice Warner, from whom he got his original stock nearly three years ago. Miss Warner, one of the pioneers in this unique enterprise, has been selling domesticated worms all over the world for the past eleven years.

Much know-how was compared and exchanged during this meeting, while the very promising prospects for the future of this infant industry were explored.

BOTANY FOR THE GARDENER (13)

By DR. WILLIAM H. EYSTER

THE PLANTS IN THE SOIL

The Higher Fungi

ASSOCIATED with the bacteria, actinomycetes, yeasts, and molds in the decomposition of plant and animal remains are the higher fungi. In respect to the role in soil processes, these fungi can be divided into three distinct groups: (1) those that live freely in the soil, (2) those that are capable of forming mycorrhiza with higher plants, and (3) those capable of causing diseases in the higher plants. The present discussion will be limited to the first mentioned group. (Fig 30.)

Occurrence of Soil Fungi

It has long been known that fungi occur most abundantly in soils which are rich in organic matter and somewhat acid in reaction. In view of the fact that fungi are present in the soil both in the form of vegetative mycelium and as reproductive spores, it is difficult to estimate their abundance and quite impossible to find a basis for comparing the relative abundance of fungi and other soil organisms and their capacity for causing a certain amount of transformation in the soil. Under certain conditions, as in uncultivated soils and below the layer of humus, fungi may be as abundant as bacteria if not more so. As a rule fungi predominate in acid soils, and bacteria in neutral soils. Fungi can, as a rule, tolerate greater concentrations of acidity than bacteria and actinomycetes so that as a soil becomes increasingly acid the bacteria

and actinomycetes tend to disappear while the fungi may still be present in abundance. Of the various genera of fungi found in the soil, the most common, both in number of species and in frequency of occurrence are Aspergillus, Fusarium, Mucor, Penicillium, Rhizopus, Trichoderma, and Zygorhynchus.

Fungi occur in the soil to a depth of at least four feet or even more in humid regions. Different fungi seem to prefer different soil depths. For example, Mucor seems to be limited to the upper soil layers while Zygorhynchus occurs abundantly in the subsurface soils. The distribution of fungi in the soil is doubtless determined by such factors as moisture, aeration, organic matter, and the character of the soil. Since fungi have been isolated from the intestinal tracts of different insect larvae and earthworms, it may be assumed that these organisms act as carriers of the spores of soil fungi. To the extent that the beneficial soil fungi require the conditions which prevail at a certain depth in the soil, digging and cultivation must be regarded as undesirable cultural practices.

Fruiting Structures of Soil Fungi

The higher fungi are better known to the average gardener than most other plants in the soil because they form above the surface of the soil characteristic fruiting structures which produce the spores, the reproductive structures. Meadows and pastures are dotted with fruiting structures commonly known as mushrooms and puffballs, while the forest floor is highlighted with the varicolored fleshy fruiting structures of Amanita, Boletus, Collybia, and many others; the fantastic coral fungus (Clavaria); and the less conspicuous but equally interesting cup fungi. Some of the more common types of fruiting structures are shown in Fig. 31.

Role of Soil Fungi in Decomposition of Organic Matter

On the basis of their relation to organic matter the fungi in the soil

Fig. 30

may be divided into five groups: (1) *humicolous* forms, which grow on practically pure humus; (2) *terricolous* forms, which grow in soil with some organic matter; (3) *fimicolous* forms, which grow in manure and may be regarded as a special type of group 1; (4) *hypogeous* forms, which grow below the surface of the soil and as such are a special type of group 2; and (5) *lygnicoleous* forms, which grow and live on the lygnin of plant materials.

Fungi play an important role in (1) the rapid decomposition of complex organic substances, and (2) the assimilation of soluble inorganic nitrogen compounds and mineral salts, especially in the presence of available energy, thus removing them temporarily from the soil solution. The addition of such organic materials as stable manure rich in straw, green manures, and other plant residues to the soil greatly stimulates the activity and growth of fungi. The kinds of fungi vary according to the kind of organic matter that is added to the soil. For example, stable manure stimulates the growth of Penicilliums, Mucors, and the actinomycetes, while cellulose in the form of straw or sawdust favor such cellulose decomposing fungi as Fusarium, Monosporium, Trichoder-

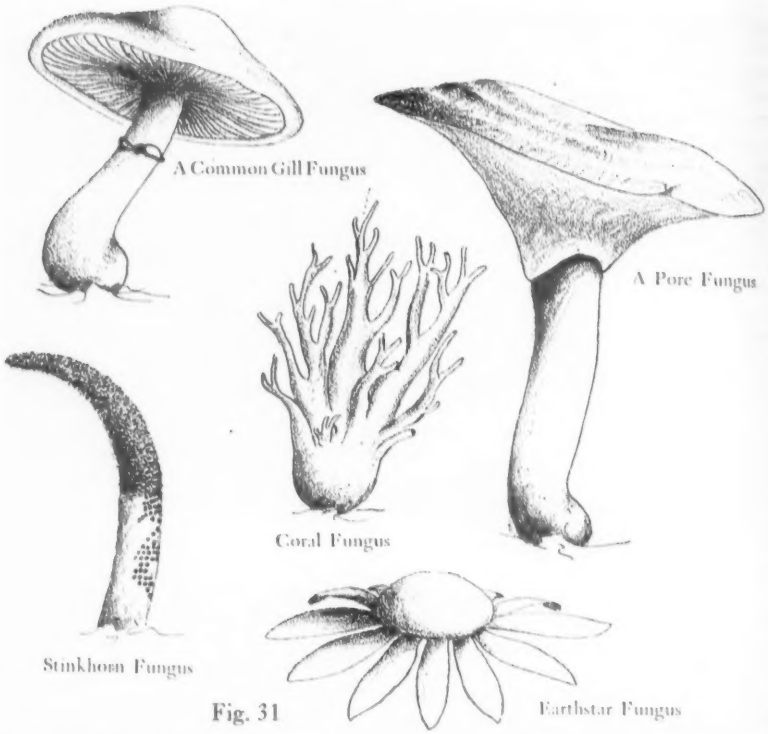


Fig. 31

ma, Verticillum, and certain species of Penicillium. It is because the available nitrogen and other essential elements in the soil are so completely, even though only temporarily, used by the soil fungi in the carrying on of their life functions that a crop should not be planted in a soil to which has been applied raw organic matter in the form of green manures and fresh stable manures. It is necessary to wait until the soil organisms have more or less completely digested the raw organic matter in the soil before a crop is planted.

Soil Fungi and Nutrition of Higher Plants

The importance of fungi in the growth of higher plants may thus be both beneficial and injurious, depending upon conditions brought about by the application of raw organic matter and the time of planting the higher plants. This relationship is well illustrated in the "fairy ring" shown in Fig. 32. When spores of the fungus, *Agaricus* germinate they grow out in all directions to form rings of growth in the soil. The outward growth is slow, amounting only to about five inches per year. At first the sod is stimulated by an increase in the available nutrient elements resulting from the decomposition of the organic matter in the soil, then killed by a deficiency of moisture in the area of dense mycelium (vegetative growth of the fungus). When, after a time, the mycelium dies and begins to decompose, the native grasses again become luxuriant as a result of the release of the nutrient elements from the fungus mycelium.

Under favorable conditions and in the presence of available energy, fungi grow very rapidly in the soil and produce large amounts of carbon dioxide. The decomposition of cellulose and of allied compounds in the soil and transforming them into humus by fungi is

of great importance in soil fertility. Their numbers are greatly increased when raw organic matter is added to the soil. The addition of one percent of cellulose to the soil in the form of pure filter paper may lead to an increase in the number of fungi from 50,000 to 1,250,000 per gram in two weeks. It has also been found that the application of a volatile antiseptic to the soil will kill soil fungi and greatly reduce the rate of cellulose decomposition.

In the breaking down of raw organic matter the different fungi work somewhat like specialists, depending upon what specific enzymes they can produce. For example, the Mucorales decompose pectins readily and allow the individual cells of the decomposing material to separate, as in rots; whereas *Botrytis* and other fungi decompose the celluse and lignified cell walls themselves. The fungi may be regarded as the real humus builders in the soil. Fallen autumnal leaves are penetrated with fungus mycelium which decompose them rapidly, decomposing them into humic substances. This decomposition can be greatly accelerated by grinding the leaves so as to expose increased surfaces to the action of the mycelium.

In addition to cellulose and allied compounds fungi also play an important role in the decomposition of organic nitrogenous compounds. In the presence of available carbohydrates the fungi use the nitrogenous compounds only as sources of nitrogen, while in their absence they utilize the nitrogenous substances as sources of carbon and of nitrogen. Any excesses of nitrogen in the protein molecule over that required by the fungus for the building up of its own protein will be left as a waste product in the form of ammonia.

Fig. 32

Plan ahead When You Buy Nursery Stock

By JOHN SHRAGER

SOMETIMES you have to wait a year or two to see how your trees or shrubs will look. With some slow-growing or very young plants you have to wait much longer. And if you've chosen unwisely, you may be terribly disappointed. When you buy a specific variety of nursery stock, you can trust your nursery to give you the variety you ask for. You can be confident that the peach tree you order will produce the kind of peaches you want—that your "dwarf" apple trees are actually dwarfs, not young giants. You can be confident that your Montmorency cherry trees will really bear Montmorency cherries—as specified in the catalog. You have confidence and faith in your nursery. And you will find that your nursery is worthy of that trust.

But, *nurserymen are not mind-readers!* Nurserymen cannot inspect each garden, or render individual soil-testing service, or check your order against the requirements of the environment in which you will expect the stock to grow. If they could, there would be less trouble from improperly placed trees and shrubs.

Suppose, for instance, you were going to order a willow tree for a spot near your septic tank. If your nurseryman knew where you were going to put the willow, he might refuse to sell it to you. He would know that in a few years the tank would have to be ripped up, the tree cut down because thousands of thirsty willow roots would have clogged the septic system pipes.

Because your nurseryman cannot visit you personally, it's up to YOU to be sure you order the proper plant for the environment in which you expect it to grow. When ordering your nursery stock, keep in mind such factors as seashore exposure, the lack of water on a dry hillside, or the severe cold of mountain country. In areas where strong winter winds prevail and very low temperatures rule, only the most rugged plants should be selected. Study the plant's future environment, keeping in mind a picture of how it will appear when full grown. For example, don't put a young pine tree next to your foundation. It will grow so fast you will soon have to cut it down. Also avoid planting too many small trees around your foundation.

You have probably often seen overcrowded foundation plantings—runted, scrawny specimens struggling for survival against each other. Many people also show bad taste by ostentatious display of rare, expensive specimens fairly shrieking "Look-how-much-we-cost!" Of course, a few uncommon dwarf shrubs may be used to good advantage. As always, buy with an eye to the future appearance of your home.

Be very wary of the large growing species—Maple, Arbor Vitae, Spruces, Pines and Hemlocks. In selecting your trees look out for such kinds as will outgrow their intended effect. One of the greatest mistakes in planting trees around the house is to use forest varieties of Spruces and Pines—fine, baby specimens when you plant them—but, Oh, My!—what a few years will do! Those stunning little cuties that once caused the neighbors to "ooh" and "Ahh" are now so big you have to chop them down and replant with smaller species.

As we mentioned before, weeping willows have an uncanny habit of sending roots into the tiniest cracks where they can get moisture. Concrete pits, tanks, wells, septic tanks,—almost anything with water in it can be ruined by a willow tree. If you have a large place and can set your willows at least 35 feet away from pipes, do so. Otherwise, it's safer not to buy them. Same for maples, elms and poplars.

If your garden is very shady, and you want to use evergreens, buy only hemlocks. Any other evergreens you might buy would probably not do as well. Keep hemlocks at a reasonable height by trimming or clipping their new growth once or twice a year, preferably in the early summer. Otherwise, come ten short years, and you'll have to call in the foresters to cut the things down.

If you have a small plot, you will not want large, overgrown fruit trees. Instead, you can now order many varieties of dwarf fruit trees. While their yield is not so great as the standard size specimens, there will be less encroachment on your other plantings. If you are buying apple trees—dwarf or regular—don't buy cedar trees also. Red cedar is a host for the cedar-apple rust fungus. Brown galls growing on cedars release spores of rust disease in the spring, resulting in the infection of apple trees up to a mile or more away.

Keep your trees away from your

garden where their roots will rob your vegetables and flowers of much needed nourishment. Elm trees in particular are bad, because their roots spread over the ground surface. This habit of ground feeding makes elms especially bad on lawns.

Were you going to buy a Norway Maple? Think twice! Norway Maples grow quickly into large, massive trees with dense green foliage—so dense, actually, that little light can get through to plants beneath them. And Norway Maple roots are very, very greedy. So too, with Chinese Elm, Silver Maple, Mountain Ash and Rock Maple. If you've a small place, select trees with smaller root spread—Crabapples, Magnolias, Flowering Cherries, Dogwoods, etc.

If you would frame an exceptional view with young trees, allow plenty of room for full development at maturity. Some grow ninety feet tall—others only ten feet, and if you're not careful —*troubles!*

For permanence, select only sturdy specimens. Although many weak but quick-growing trees make a splendid display, in a short time they are easily broken by snow and sleet storms.

Keep an eye overhead for electric wires. Think twice before you buy a tree that will grow tall in a short time, resulting in expensive pruning bills or law suits by your power company.

We've tried to put you on your guard. The rest is up to you. Your nurseryman will do his part and you will have no regrets if you do yours.

But—*buy with an eye to the future!*

Grandfather's Weed

Grandfather was a philosopher as well as a keen horticulturist. Somewhere in his trim flower borders, in a not too conspicuous situation, he used to let a weed grow.

On being asked the reason for this apparent oversight, the old gentleman, with a whimsical smile, gave this explanation:

"I let that weed grow there for two reasons.

"First, to teach me true humility—to remind me that man is but a weed in the garden of Life.

"The second reason is to give my friends pleasure. My friends come here to see my garden. I point out my choice specimens which they appreciate and admire. They see my lovely roses and are duly delighted, but nothing in my whole collection gives them anything like the keen pleasure they derive from tapping me on the shoulder, pointing to the weed and saying, 'Look, you've missed that one'!"

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ORGANIC GARDENING WILL SOLVE YOUR GIFT PROBLEM!

One Man's Garden

By AVERY NELSON

A compost pit seven feet square that yields two and one-half to three tons of compost a year. Sweet potatoes that weigh three and a quarter pounds. Parsnips 23 inches long, perfect shape and sweepstakes winner at a Garden club show. No corn borers or ear worms and no tomato worms or blight. Roses good enough to capture most prizes at flower shows.

That's the story of O. A. Severance, Watertown, N. Y. photographer and organic gardener. Severance began ten years ago with a garden plot 60 by 100 feet. Productivity the first year was exactly zero. Nothing had been done for years to improve the soil.

Today his compost pit produces corn nearly ten feet tall, tomatoes in such profusion that neighbors come daily to look at them and flowers that draw hundreds of visitors. He uses no commercial fertilizer, no poison sprays.

His compost pit is surrounded by a wall of loose field stone seven feet square on the inside and two feet high. The wall is laid on top of the ground. The soil inside is dug out a foot deep. Into this pit go a small truckload of hen or stable manure, leaves, weeds, garbage, lawn clippings, sun-flower stalks left standing over winter for the birds, sod if available and ground limestone.

This is built up layer on layer according to accepted organic gardening methods of making compost. The pit is full to the top of the stones when it is completed May 1. Severance turns the pile in three weeks when he estimates the temperature has reached 150 degrees, and the temperature gradually declines from this point.

Four weeks later he turns the pile again. On August 1 he takes out 22 100-pound wheelbarrow loads of finished compost on the average. This is used largely for mulching, which he believes can hardly be overdone at this time of year.

The next pile is started as soon as the first is out. He keeps adding to it all the rest of the summer. It stands all winter and is ready to be used the following May 1 in rows and hills under the seeds and plants.

The loose stone wall is the best method of making compost, Severance believes. It lets air in all around, the sides don't dry out and the temperature is more even. More or less humus is left among the stones and on the bottom of the pit to serve as an activator and start the next pile going.

"It is not a bad looking spot, especially if some shrubs are grown around it," he said. "The little extra work involved in having this kind of a pit is more than offset by the convenience of having a handy place to dump waste."

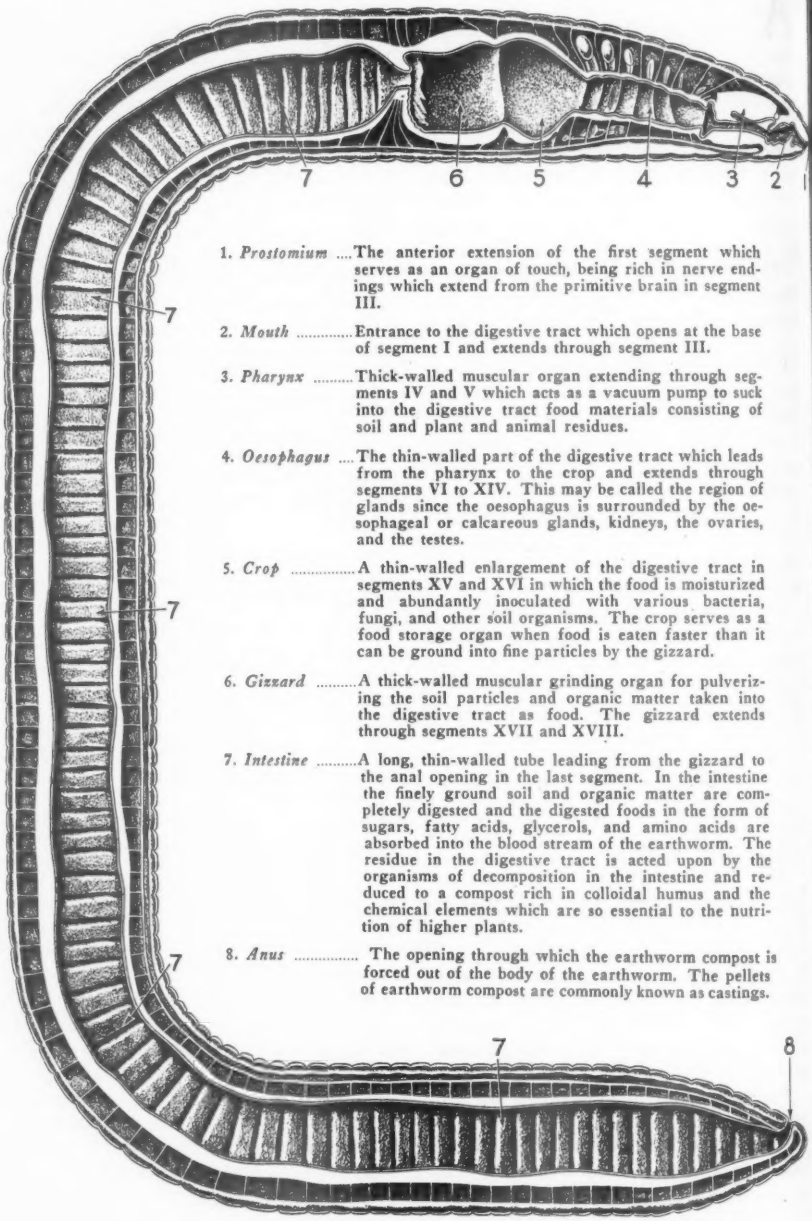
Severance believes in keeping the soil covered at all times. He sows winter rye, rye grass and vetch as soon as crops come off or awhile before. He sows crimson clover in the corn when it is planted. This holds the moisture, keeps weeds down and is good for the corn. In the spring the rye is usually too high to spade under so he cuts and puts it in the compost pile.

"Nearly everyone knows about compost and how to make it, and how the soil is crying for it," he said. "But so many gardeners shy off because they feel it is a lot of extra work. In fact it is very little work when it is carefully planned, and it really saves more work than it makes."

Severance grows his tomatoes year after year on both sides of a wire trellis, Rutgers on one side and Jubilee on the other. Tieing up is unnecessary since the vines are supported by this overgrown fence. He feels some support is necessary for quality tomatoes and the soil is kept at high level of fertility by constant addition of compost.

THE EARTHWORM .....

Longitudinal Section to show Parts of the Digestive Tract.



1. *Prostomium* ....The anterior extension of the first segment which serves as an organ of touch, being rich in nerve endings which extend from the primitive brain in segment III.

2. *Mouth* .....Entrance to the digestive tract which opens at the base of segment I and extends through segment III.

3. *Pharynx* .....Thick-walled muscular organ extending through segments IV and V which acts as a vacuum pump to suck into the digestive tract food materials consisting of soil and plant and animal residues.

4. *Oesophagus* ....The thin-walled part of the digestive tract which leads from the pharynx to the crop and extends through segments VI to XIV. This may be called the region of glands since the oesophagus is surrounded by the oesophageal or calcareous glands, kidneys, the ovaries, and the testes.

5. *Crop* .....A thin-walled enlargement of the digestive tract in segments XV and XVI in which the food is moisturized and abundantly inoculated with various bacteria, fungi, and other soil organisms. The crop serves as a food storage organ when food is eaten faster than it can be ground into fine particles by the gizzard.

6. *Gizzard* .....A thick-walled muscular grinding organ for pulverizing the soil particles and organic matter taken into the digestive tract as food. The gizzard extends through segments XVII and XVIII.

7. *Intestine* .....A long, thin-walled tube leading from the gizzard to the anal opening in the last segment. In the intestine the finely ground soil and organic matter are completely digested and the digested foods in the form of sugars, fatty acids, glycerols, and amino acids are absorbed into the blood stream of the earthworm. The residue in the digestive tract is acted upon by the organisms of decomposition in the intestine and reduced to a compost rich in colloidal humus and the chemical elements which are so essential to the nutrition of higher plants.

8. *Anus* ..... The opening through which the earthworm compost is forced out of the body of the earthworm. The pellets of earthworm compost are commonly known as castings.

EARTHWORMS

Living Subsoilers and Composters

By DR. WILLIAM H. EYSTER

IN His infinite wisdom God created and distributed widely over the landed areas of the earth thousands of species of earthworms so that the soil may be maintained in a highly productive condition. In size, earthworms vary from those species which are almost too small to be seen without the aid of a magnifying lens to those giants of the earth which are as much as 3 to 10 feet in length. They are known by such colloquial names as angleworm, fishworm, orchardworm, rainworm, dewworm, night crawler, and manureworm. The importance of these animals in the soil can hardly be overestimated. Charles Darwin maintained that without the work of this humble creature we cannot have land capable of cultivation.

Nature's Subsoiler

The earthworm is a self-propelling subsoiler which appears to be sensitive to light and sound, and the nerve endings in its skin make it highly sensitive to touch. Also its sense of taste is highly developed as it exhibits preferences for certain kinds of food. Its organs of locomotion consist of 4 pairs of setae (hair-like lateral appendages) in each segment and longitudinal and transverse muscles which alternately expand and contract. When the longitudinal muscles expand and the transverse muscles contract the body of the earthworm becomes longer and thinner, while when the longitudinal muscles contract and the transverse muscles expand it becomes shorter and thicker. In locomotion forward, the anterior region of the extended body of the earthworm is anchored to the ground by the setae which can be oriented in almost any direction, and the posterior region is drawn up by the contraction of the longitudinal and simultaneous expansion of the transverse muscle. The waves caused by the contraction of the longitudinal muscles and the simultaneous expansion of the transverse muscles travel along the worm from posterior to anterior end in the form of a peristalsis.

The earthworm is first of all a subsoiler in that it burrows into the soil to a depth of several feet although it spends most of its time in the layer containing organic matter near the surface. These burrows tend to make the soil more and more porous and this enables the soil to absorb an increasing proportion of the water which falls upon its surface. This is important because water in the soil is one of the most essential natural resources for the growing of plants. It is amazing how much water is required for the growing to maturity of a single corn or potato plant. The earthworm burrows also facilitate the proper aeration of the soil and thus enable the beneficial aerobic soil organisms to live in the soil and play their natural roles in humus-making. Earthworms can break up hardpans in the soil even more effectively than the tractor-drawn mechanical subsoiler. By following earthworm burrows the roots of plants find easy and desirable penetration into the deeper layers of the soil. The

lining of the burrows seems to stimulate root growth. The movements of the earthworms through the soil play an important part in the distribution of such organisms of decay as bacteria and fungi.

Through lack of proper aeration even a soil rich in organic matter may become infested with wireworms which live for the most part anaerobically. Wireworm infestations usually can be eliminated by building up the earthworm population of the soil. The same can be said of other undesirable organisms which live anaerobically in the soil.

The amount of subsoiling that the earthworm population of a soil rich in organic matter can do is astounding but varies according to the conditions that prevail in different soils. Darwin in his book, "The Formation of Vegetable Mould", estimated that more than 10 tons of dry earth annually pass through the bodies of earthworms and are brought to the surface on each acre of land in many parts of England. In later studies it has been found that earthworms may deposit as much as 200 tons of earthworm compost on each acre of land.

Nature's Composter or Humus Factory

The earthworm's body is a remarkably constructed and efficient composting machine which provides for optimum conditions of moisture, aeration, inoculation, grinding, neutralizing, and conversion of just the right mixture of soil particles and organic matter into colloidal humus. The body wall of the earthworm is naturally moist and can absorb water directly from the soil and transfer it to all parts of the interior of the animal. Oxygen from the air also passes through the skin and enters the blood stream which carries it to all parts of the body including the digestive system where digestion and microbial decomposition are taking place. In thus making available sufficient amounts of moisture and oxygen, the skin plays a most important role in the composting process that takes place in the digestive tract. (See labeled drawing on page 36.)

The materials which the earthworm takes into his body as food and thus become available for composting include inorganic soil particles of different sizes, all kinds of plant and animal residues and soil organisms. It is doubtless no mere coincidence that the kinds and proportions of materials used for making compost in the digestive tract of the earthworm are similar to those recommended by the late Sir Albert Howard in his Indore process. Sir Albert repeatedly went to Nature for answers to his questions. The earthworm finds its food materials largely with its prostomium, the anterior prolongation of the first segment, which is especially rich in sensory nerves. This nose-like front end of the earthworm's body is soft and with a little pressure flattens out over the object that is being examined by the animal. When suitable food has been found, it is sucked into the digestive tract through the mouth by the thick-walled pharynx which acts as a suction pump. As this food material passes through the thin-walled oesophagus it is impregnated with various digestive juices and animal hormones.

Unusual as it may seem, the five pairs of hearts, the ovaries, the testes, and the lime-forming glands occur in this part of the earthworm's body. It is here that any unfavorable acidity of the food materials is corrected by the secretions of the lime-forming glands. By this time also, the food material is well inoculated with soil organisms which are taken into the digestive tract with it.

The food mass empties out of the oesophagus into the crop, a thin-walled enlargement of the digestive tract where the food is stored temporarily until it is fed into the gizzard. In the crop the food mass is softened and the soil organisms are further incubated.

The gizzard is a most efficient grinder or mill in which the food materials are ground into a fine paste in preparation for the digestive and compostive processes which take place in the long, tubular, thin-walled intestine

which extends from the gizzard to the last segment of the worm's body. By the time the food mass is excreted through the anal opening in the last segment the digested parts have been absorbed into the blood stream and the residue has been converted into colloidal humus which is unusually rich in nutrient materials essential for the growth of higher plants. This excreted humus is ejected in the form of pellets which often are referred to as *castings*. In these castings the concentrations of the elements essential in the nutrition of higher plants are considerably higher than in the soil in which the earthworm lives.

Earthworms may well be considered the most important livestock on a farm or in a garden. They should be fed and must be protected, especially during the winter months. This can be done most easily by maintaining a good cover crop in the soil or a protective mulch on the surface of the soil during the winter months. To the extent that the tractor has replaced horses and mules on the farm, the earthworm has become increasingly essential. This lowly farm animal is equally available to both rich and poor in maintaining the soil in a highly fertile condition.

Earthworms in Compost Pits

By adding earthworms to a compost pit after the heat of fermentation has subsided, mechanical turning with a fork or other device is not necessary. The earthworms grow and reproduce so rapidly that they soon occupy every part of the compost heap and greatly aid the composting process. The manure worm is especially adapted for doing this work in the compost heap. By grinding the plant materials into relatively small pieces and filling the pits only to a depth of a foot or so, earthworms may be added immediately for carrying on the composting process from the very beginning, as occurs in nature.

An Earthworm Garbage-composter

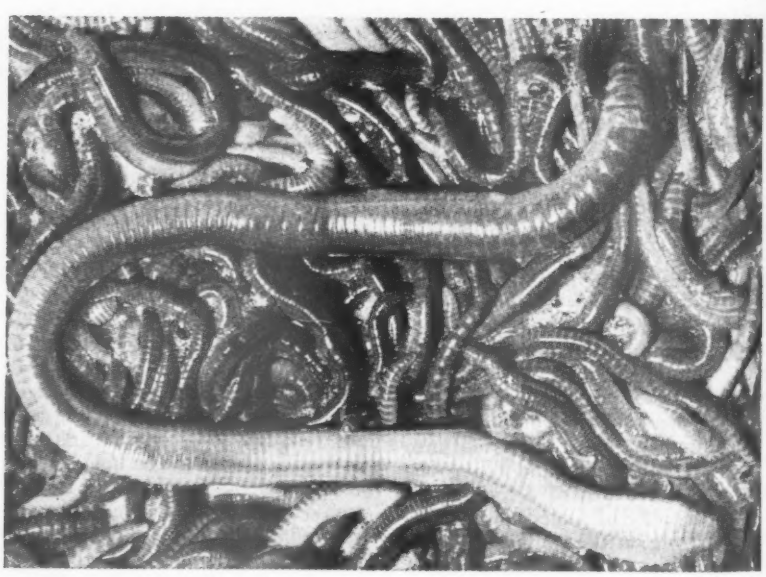
The disposal of garbage is a problem that must be dealt with by every American family. In the country and small town it is a problem that must be solved by each family. In the larger towns are private parties who collect the garbage for a fee and use it for feeding hogs. In many boroughs and in cities are tax-supported community garbage services which collect the garbage on specified days. The collection of garbage which usually is hauled to a dump and destroyed represents a tragic waste of highly valuable and essential organic materials which are so much needed by our garden and farm soils. It is easy to see that a gardener who sends his garbage away to the dump via a garbage collector is robbing his soil of its greatest need, i.e. its organic matter.

A highly satisfactory family garbage composter can be made as follows: Dig a pit 4 feet square and 3 feet deep and fill it with a compost heap made according to the Indore method: In the bottom of the pit put a layer of plant materials 6 inches deep and wet it until it has the moisture content of a squeezed sponge. Over the plant material place a layer of manure 2 inches thick (1 inch of poultry manure is sufficient), a ⅛-inch thick layer of soil, and a sprinkling of pulverized limestone. Repeat this layering until the pit is filled. After the heat of fermentation has subsided, add at least 1500 earthworms. This may be done by opening the top at different places, introducing some of the worms, and again closing the top. Sixty days after the earthworms are introduced, the composter will be ready for operation.

As garbage accumulates it is put into the composter by opening a hole large enough to receive it. After the garbage is placed in the hole, it should be covered by some of the material removed from the hole. The next accumulation of garbage should be put in a hole similarly, but in a different part of the heap. After a composter of this type is well established, it will take care of the garbage of a family of 6 persons. A charge of garbage will be converted into compost

in about 3 days. After the pit has been used for a time and is rich in colloidal humus, half of it should be removed and used on the garden, flower beds, or lawn and refilled with plant and animal materials as originally. At intervals of 2 to 3 months the compost in the older half of the pit should be used and filled with fresh organic matter.

The earthworm composter may be used also for disposing of the wastes from dressing poultry for the market or for the kitchen. Prepare a pit as described above and inoculate with earthworms. When the pit contains a large population of earthworms, remove one half of the material in the pit as follows: Rake off the top of the pit, and remove one half of the contents of the pit. Then put down a layer of weeds or other plant material 6 inches deep. On this layer of weeds place the feathers, heads, and water used in removing the feathers. Cover these animal materials with another layer of weeds. Over this layer of weeds place a layer of clay soil. On the layer of soil put the entrails and other parts of the animals that are to be discarded. Then cover these animal materials with a layer of weeds 6 inches thick. Over the layer of weeds place a layer of soil. Then rake back over the pit the top cover to a thickness of 6 to 8 inches. Experience with this type of composter for disposing of the wastes from a poultry dressing plant has been that the heap sinks 12 to 15 inches in 3 days. An examination shows that in this time the waste materials except the feathers are almost completely decomposed by the earthworm.



Health and Humus

By ROGER W. SMITH

WE all know what is meant when the soil of a sour area or a place excessively saline or alkaline is called "unhealthy soil". The soil of such a place cannot produce healthy vegetation, that is, vegetation capable of promoting health in man or beast.

In the same way, we readily understand what is meant by "healthy soil". Such soil is usually deep. It is rich in mellow organic humus. It is sufficiently open and well drained so that it is itself healthy. Such a soil has a pleasing fragrance when tilled. It is easily handled and has a "clean" feel. It is healthy soil capable of supporting healthy plant life.

This general distinction between healthy and unhealthy soils has been common knowledge since very remote times. The basic principles of maintaining and improving soil health by drainage, tillage, manuring are very ancient. It has long been known that a soil may be improved by the addition of manures and the rich humus formed by composting.

But mankind has ever been shiftless, a heritage from nomadic days. The world was infinitely large. If the soil became rundown, unhealthy, it was easy to move on to greener pastures. Occasionally there were desperate periods such as that in which the Roman farmers were exhorted to plant and plow-under legumes to restore fertility. Their plight is repeated in our own day in our struggle against dust-bowls and erosion.

Of course the organic gardener knows that the layer of humus covering the subsoil must be maintained; that the best way to do this is through the use of composted organic humus. He knows that healthy humus can be quickly used up in cropping; that it is just about as possible to grow plants without healthy humus as it is to raise fish without water.

But considering the ages during which mankind worked and wondered about such matters it is a peculiar fact that it was not until rather recent times that he began to closely examine the structure of healthy humus. Could it be that some definite substance existed in this humus that gave it health? Did this substance cause plants to be healthy? Could this substance be secured and used to promote human health?

Such questioning was primitive and in line with the alchemists' search for the foundation of youth, but it had behind it much supporting evidence. It was made plausible by the fact that healthy humus was essential to human health. Grass from meadows rich in organic humus fed cows which supplied milk in abundance. Chickens and the like, when given access to healthy humus improved and thrived. "Richness" in farmlands meant healthy humus.

Other little things seemed to point the way. When young pigs were fed quantities of healthy humus, or were allowed to dig into it, they were usually immune to scours and other serious intestinal ailments. Wherever one looked healthy humus seemed to be a promoter of human health. The old adage, "Eat a peck of dirt before you die" bears the inference that to be healthy and long lived one must consume a peck of dirt.

Doubtless some such simple and direct reasoning originally guided the "earth eaters" in their search for that elusive substance which would insure them health. Earth eating is a quaint custom not unknown even today in the south eastern states. It is particularly prevalent in those areas in which pellagra is most prevalent—an interesting point.

Earth eaters often travel many miles on foot to reach just the right kind of earth. Generally, the most favored spots are distinctly clayey and covered with a rich layer of healthy humus. Earth eating may seem crude and unscientific but it remains a fact that healthy humus is not without its vitamin content. This is worth remembering, for it is also significant that earth eaters usually prefer a soil that tastes pleasantly acid—somewhat like fresh lemon juice. It is not beyond the bounds of possibility that the earth consumed has value as an antiscorbutic, extremely valuable in preventing serious vitamin deficiency disease.

What has modern science found regarding health giving humus?

Modern science works its wonders in obscure ways. It has little of the direct approach, the simplicity of thought of the primitives. During recent years scientists have turned their attention more and more to the possibility of discovering health-giving substances in healthy humus. Three really important aids to human health have been found as a result of this searching examination of healthy humus. It is likely that many more will follow.

First, of course, there is penicillin. This substance, discovered by Fleming, is obtained from the micro-fungus *Penicillium notatum. P. notatum* is one of the "cosmopolitan" organisms, so named because they were believed to live everywhere. They are closely associated with the decomposition of vegetable matter. They cause that "dirty grey" look on falling leaves, fence posts, etc., in the late autumn. *P. notatum* is an important member of the compost heap micro-organisms and finds its way to healthy humus often via leaf mulches and the like.

The next substance to be derived from healthy humus is now called tyrothricin. It was originally called gramicioin in honor of the great scientist Gram. It was discovered in 1939 by Dubos. Tyrothricin is yielded by a motile, spore-bearing, soil inhabiting bacillus called *Bacillus brevis.* This micro-organism is commonly found in healthy humus and compost heaps.

The third substance is called Streptomycin. It is quite new. It was extracted by its American discoverer Selman Waksman from yet another soil organism, *Actinomyces griseus.* Not too much is known of the nature of the actinomyces of the soil. They are not much larger than bacteria. They exist in great numbers in the compost heap. They are plentiful in healthy humus especially new humus. They have the ability to break down cellulose.

Thus we have three immensely valuable health-giving substances derived from the micro-organisms which are commonly found in the compost heap. But these three are curiously dissimilar and their products equally so.

P. notatum is a mold. *B. Brevis* is a bacterium. *A. griseus* is sort of in between. The product of *P. notatum,* penicillin, can be used in the human bloodstream; the product of *B. brevis* can not, its value lies in its ability to heal open wounds. The product of *A. griseus,* streptomycin is still very scarce. It is exceedingly valuable taken internally. Its value lies in its ability to fight disease bacteria in the human intestinal and urinary tract.

This newest product of the compost heap molds, streptomycin, promises to wipe out undulant fever, Bang's disease in cows, scours and intestinal ailments in pigs, shipping fever in cattle. A list strangely reminding one of the value of feeding of healthy humus to young pigs.

The interesting point to note in these three new substances is that they are not only the product of healthy humus but the product of three very

widely different soil micro-organisms and that each of these tiny organisms represents an enormous group. By selecting other members of each group important and almost infinite variations are possible in the resulting product.

More important even than all this is the fact that modern science has at last turned to an examination of many long forgotten soil organisms, to a study of healthy humus and the compost heap.

Following the fine pioneer work of Dubos, Fleming and Waksman, many thousands of soil micro-organisms have been isolated and examined and the substance obtained from them tested. Many of the actinomycetes or "ray fungi" of the compost heap have received close scrutiny. Waksman and his associates have paid very close attention to organically manured fields and to compost heaps.

Among other organisms tested, Chatomium mold yielded a substance even more potent than that yielded by *P. notatum*. Tests with a lavender mold called *Streptomyces lavendulae* led researchers finally to *A. griseus*, so named because of its mottled grey or grizzly color.

The penetrating, indirect light of the modern microscope has been turned on the denizens of the compost heap. Modern science has turned suddenly, because of Fleming's discovery of penicillin, to a very close study of healthy humus and its normal occupants.

A thimbleful of healthy humus may contain many millions of micro-organisms. Poor, unhealthy soil usually contains few whereas rich, healthy humus is teeming with life. Many of the life forms are harmless, many more are beneficial—that is, beneficial to man and to plant life—a very few are pathogenic to man.

In the soil are a few organisms apparently unfavorable to human life, these produce "lumpy jaw" in cattle, athletes' feet and tetanus in man. It has been definitely shown, however, that the worst offender—the organism which produces tetanus (lockjaw)—is most common in humus which contains large quantities of new, raw horse-manure. Because of a very small percentage of organisms known to be pathogenic to man, the whole vast soil population has long been condemned as poisonous or infectious. The "universe-in-a-thimble" was despised. Today, it is a pearl of inestimable value.

Today, scientists are attempting to get a clearer picture of the great healing power of the denizens of the "universe-in-a-thimble" and to utilize it. Several healing substances have already been obtained, others are doubtless on the way. Sudden and spectacular results may come when some of the lesser known groups of micro-organisms long known to live in healthy humus are investigated.

One would think that with such a vast field suddenly opened for exploration modern scientists would have enough on their hands, or more than enough. On the contrary they immediately go to work and attempt to form imitations of the real thing.

The brilliant performance of the sulfa drugs has really been set at naught by these new, organically produced and relatively homely substances. It is doubtful if any form of life is more generally widespread than the spores of many groups of soil micro-organisms.

But what does science do? Long perverted by a false value set upon such matters, science immediately sets to work to find out how to create imitations of the real thing. To explain why this occurs so spontaneously it would be necessary to go into what might be called the system of modern cabalism.

Just as soon as anything really good is discovered, the hunt for a cheap imitation is underway. The cabala, you will remember, gave the letters of the alphabet numerical and fluctuating values. It was something like algebra but much more elastic. In much the same way modern science decides upon the number of molecules or atoms —utterly invisible entities—which compose a given substance. They will

rebuild the substance atom by atom, create a synthetic substance.

Before we go too deeply into this matter of synthetics, it might be well to remember that the organic gardener is well informed regarding the elements which govern soil and humus. He is a practical man with a penetrating knowledge of natural processes. He knows, for example, that if he leaves a healthy soil these things will eventually be disintegrated sooner or later —but much sooner if the soil is healthy. He knows that this disintegration is the result of the activity of healthy soil micro-organisms.

In a very dry, sandy area the processes of disintegration are much slower, note the slowness with which Egyptian remains return to the soil. Naturally, this slowing down is so because of the scarcity of soil micro-organisms.

Somewhat the same conditions prevail in a sour swamp. Here the check upon microscopic life is brought about by acidity. Trees submerged under such conditions are often perfectly preserved for centuries.

Healthy humus absorbs all that is organic, whether this be corn stalk or tree trunk, leather or linen. It does this because its billions of inhabitants are hungry, incessantly hungry. Some of them can consume many times their own weight in a single hour.

Healthy humus is teeming with beneficial bacteria, moulds, and minute single-celled animals called protozoa. We must assume that a soil is healthy because the right kind of soil organisms are numerous in it. Healthy soil organisms are most numerous in soil which contains ample organic matter. They break down the raw vegetable matter in the compost heap. They continue their amazing activity in the soil. Some of them eat this and some that, almost all of them need moisture. Some of them can consume cellulose and some can not.

It was their remarkable appetite that finally caused the microscopes of science to be turned upon them. Dubos speculated upon the possibility of using some of the most active micro-organisms of the compost, or their secretions, to destroy disease germs in the human body. In some ways, this thought seems to be merely a refinement of the beliefs of the earth eaters.

Modern science has discovered a vast new field from which many new, health-giving substances will undoubtedly be drawn. On the other hand, there is this business of synthesis, the manufacturing of chemical imitations.

So far, those who would produce synthetic penicillin or tyrothricin or streptomycin haven't succeeded for very obvious reasons. Sooner or later, however, they will manage it, and the market will be flooded with a cheap imitation claiming all the value of the real thing.

Now a synthetic product is a reasonable facsimile of the real thing, it is ersatz, it is imitation. Its only value lies in the fact that it is cheap.

The organic gardener knows all about the effects produced by the use of synthetic fertilizers. We don't have to go into that. The danger of using synthetics in medical practice is even more pronounced, if that could be possible. Synthetic vitamins, like synthetic fertilizers, often fail to produce the result expected from them; often massive doses are required.

In the past, many synthetics were imitations of inorganic chemical substances, relatively simple substances. The difficulties facing the manufacture of synthetic substances having the ability to duplicate the action of the products of micro-organisms who "live but an hour" will be extremely difficult. Unfortunately, the fact that synthesis will follow difficulty makes it the more obvious that many of the first substances produced will be definitely poor imitations of the real thing.

But some progress has already been made, for science has courage. Already synthetic streptomycin is being produced. It has been found that streptomycin contains 21 carbon atoms, 7 nitrogen atoms and 12 oxygen atoms. The analysists weren't so sure about

hydrogen—there may be 37 or 39 hydrogen atoms. This fact really doesn't matter so long as the approximate combination can be made. Also no one is particularly interested in how well the synthetic product works out provided it is cheap.

The subtle dangers involved in its use are ignored. Long range effect is quite forgotten. And this is peculiarly important because the use of even the real substance is not always without its dangers because of the sheer potency of the substance and the tremendously different response to even slight differences.

The use of synthetic antibiotics—chemical imitations of natural organic medicines—is fraught with subtle dangers. Consider the real thing: streptomycin is the product of *A. griseus.* Streptomycin has great value. In 1940 a very similar substance, actinomycin, was obtained from *A. antibioticus.* No doubt the chemical structure of this substance was indistinguishable from the product of *A. griseus,* but its effect was markedly different. Actinomycin not only destroyed the disease germ, it destroyed the host—whether animal or man.

Thus it would seem that, regardless of the price, the use of synthetic imitations of these new organic medicines should be regarded as definitely dangerous.

After all, one might ask, why synthetics? About the most common thing in the world and the easiest to grow are those micro-organisms, beneficial to man and life in general, and most numerous in healthy humus. They are so numerous, their spores are in the very air we breath. They are termed "cosmopolitan" and "universal".

Many of them grow so rapidly that their life span is reckoned in hours or minutes rather than years. The compost heap depends upon their activity. There would be no healthy humus without them. It is not too much to say that the health of both man and his domestic animals, even their very lives, have always been dependent upon the activity of the tiny and forgotten micro-organisms.

Because of these facts, it is not surprising that modern science has succeeded in extracting from them new and wonderful health-giving substances. The wonder of it is that this has not been done long ago.

Synthetics will naturally follow rapidly in the wake of these new organic medicines. That is to be expected. "Imitation is the sincerest form of flattery".

By this time the true organic gardener will be asking, just what part do all these substances play, in the activity of these micro-organisms, what has this to do with the health of plant growth? Exactly what is the relationship between plant and micro-organism? How is the health of the plant passed on to its consumer?

Some of these questions can be answered in part. Much remains to be answered. But we do know that healthy plants grow only when their roots are anchored in healthy humus. The thing most vital for their health is this healthy humus. And the best and in the end the easiest way to secure and maintain a healthy soil is by incorporating in it the full-of-life humus formed by proper composting.

Human health and healthy humus are, and always will be, closely related.

HIS EXCELLENCY THE AMERICAN BLUEBIRD

By CARL M. SISK

IN the center of an open lawn about 100 x 75 feet, we erected our bluebird box about the first of April 1942. Within less than 24 hours there was a pair of bluebirds going in and out all aflutter with excitement. It did not take them long to make a down payment in the form of a few nesting twigs, just to let other birds, all and sundry, know that that particular apartment was taken. That year they had two broods, four in the first and five in the second.

The parents, the young and ourselves all became welded together in a friendship that lasted until the early part of November, when to insure themselves that the winter's snow would not shut off their natural food supply, they left for a point far enough South where snow coverings were, at least, of short duration. The next year the parent birds showed up about March 15th to repeat all over again the job of raising at least two broods. sometimes three. We would have liked it if the young had returned also, but no, the bluebird social order does not permit that. In fact when a pair of birds select a nesting site, they, at the same time, lay claim to an area surrounding the nest, at least as much as one or two city blocks, in which no other pair of bluebirds are permitted to nest. They proceed along very much the same lines that our early homesteaders did, once a 160 acre tract was selected and filed on, it was hands-off to all others. This procedure is undoubtedly to insure a sufficient supply of that food preferred by these birds for their young.

Bluebirds are beautiful; they are friendly and great consumers of insect life, and therefore a friend of value to man. Let us examine into each of these three characteristics.

Someone has said that bluebirds are truly American, in that they have a red breast, white undersection and blue wings and back, thus embodying

our national colors of red, white and blue. He is 7 inches long. His warble is a mellow cheery song, a low-pitched lay of four or five notes. There is an old saying that "Beauty is as Beauty does." Our subject fits into this specification nicely. He likes the society of man and if given encouragement will become quite domesticated. The flight of these azure-blue winged creatures, in and around one's home is a distinct addition to the joy of living.

My wife and I, as this is being written (June 1948), daily enjoy repeated visitations of mother, daddy and five baby bluebirds, to our feeder. The feed is a commercial corn muffin mix, cooked according to directions, placed in a dish that sets on a stand made of a 6 x 10 inch board mounted atop of a discarded music stand tripod. In bad weather we set the stand in the garage and weather good or bad these birds become so tame that they readily come to within 5 or 6 feet of where we sit, to feed, fully confident that we are their friends and protector. Like people, individual birds have individual characteristics and their coming and going provide many hours of entertainment of a high order. One of the most interesting of which is the observation that when the second brood comes along, the young of the first brood, especially the daughters, get all excited over the arrival of their new brothers and sisters. Frequently the daughters of the first brood take great delight in helping care for the new arrivals, not only feeding and sitting on them to keep them warm but by carrying out the droppings as well.

The bluebirds arrive at our place (Pike County, Pa.) in March, they seldom miss the 15th by more than one or two days, and stay until about the first of November. Thus they cover the full insect period of say from April 15th to October 15th, six full months. They feed from dawn to dark, the young consuming their weight every 24 hours.

The first brood is hatched by about May 1st and the second by June 15th. They are here all through the longest days of the year and gone through the shortest. Therefore we are safe to say that their six-month-period-insect eating-day will easily average 15 hours.

Both mother and daddy feed the young and we have repeatedly clocked them at eight visits in ten minutes. Nor do they come with just one tiny insect, even when the babies are small. They come with three or four

or more, one for each if you please. Now let's get out our pencil and do some figuring. The two parent birds are here for an insect eating period of the full six months—180 days at an average of 15 hours per day. That is 2,700 hours for each of two birds or 5,400 hours for one bird. The first brood is here for 165 days, 2,475 hours for four birds, or 9,900 one-bird hours. The second brood is here for 120 days, 1,800 hours for four birds, or 7,200 one-bird hours. Now lets recap this into total hours for one bird:

2 Old birds	5,400 one-bird hours
4 First brood birds	9,900 one-bird hours
4 Second brood birds	7,200 one-bird hours
Total	22,500 one-bird hours

As above stated we have clocked these birds making eight visits in a ten minute period. There are six ten-minute periods in one hour, so that would mean 48 visits per hour. Now to be ultra conservative lets cut that down to 25 visits per hour, with an insect for each of four birds. We take the total number of hours for the family of 22,500 and multiply that by 25 and we get the surprising total of 562,500 insects consumed by one pair of bluebirds and their progeny in just one season.

Mr. John H. Baker, Executive Director, of the National Audubon Society states that: "The bluebird has suffered more from competition of the sparrow and its companion invader, the starling, than any other native bird."

Therefore it naturally follows that to detract these bluebird enemies is to attract the bluebirds. All three will nest in boxes but a 1½ inch hole will not admit starlings but will admit bluebirds. The sparrows usually will not nest close to the ground whereas the bluebirds like a nest about five feet from the ground. (We supplement this detraction by using an air rifle when the sparrows and starlings come around.) So if you want to make the bluebirds happy get a smooth pole or a length of old pipe 7 feet long (cats cannot climb them) drive into the ground two feet and at the upper end mount the box, the inside dimensions of which should be about as follows: floor 5 x 5 inches, depth 9 inches, diameter of hole 1½ inches, hole above the floor 6 inches. The roof of the box should extend over the sides and front and fit against the back to which it is fastened by a hinge or it can be fastened by drilling two small holes in the roof so that the roof can be dropped over two finishing nails, that have been driven into and project up from the top of each side piece. The top should slant down toward the front so that rain will be quickly disposed of. Three or four ¼ inch holes in each side piece, near the top and a few holes in the bottom will provide ventilation and drainage. The birds prefer to have the box face the South or Southwest. They will accept these homes if attached to fence posts, but it is not advisable to attach them to a tree. As a farmer boy in west central Kentucky I observed that a favorite nesting spot was the end of a rail in an old fashioned snake fence (a la Lincoln), where the nest was protected by the end of the next rail above. Care should also be exercised to use wood at least ¾ inch to 1 inch in thickness. This makes the temperature more uniform inside, than would be the case of thinner woods. The boxes can be painted outside but should not be painted inside. They will also appreciate a perch about one inch below the hole. We used a forked twig about ¼ to ½ inch in diameter, one side nailed to the box and the other extending out as a perch. The nest should be cleaned out immediately after the broods leave.

In our opinion these birds are Nature's complement to Organic Gardening. Since we have had our bluebirds we have never had to spray for insects larger than aphis either in our flower or vegetable gardens.

Mr. T. E. Musselman of Quincy, Ill. is an ardent bluebird champion. He had noticed the gradual dimunition of the bluebird population over a period of twenty years and decided to

do something to bring back bluebirds. In one season he placed 102 boxes along 43 miles of country road near his home. Eighty eight of these houses were occupied the first year by these lovely birds. By applying my above estimates in the insect consumption of our bluebird family, we find that the 88 families resulting from Mr. Musselman's help represents a consumption of approximately 54 million insects. If I were farming I would have a bluebird box every two hundred yards around my entire farm. Every garden or lawn or both should have at least one box. They prefer a nest in the open—the better to spot their enemies. We have bluebirds and we use compost—a winning combination—Nature's Own.

●

Soil and Health Foundation

The Soil and Health Foundation was organized somewhat more than a year ago. At that time its aims and purposes were set forth. Since then our list of subscribers has increased to such an extent that it seems appropriate and fitting that we restate the fundamental purposes of the Foundation. We want all our readers to understand the Foundation and help us to carry out its purposes. The Foundation is a non-profit organization and the purposes for which it has been organized and incorporated are:

(a) To promote, foster, and encourage the use of humus in the soil to prevent the further loss of soil.

(b) To conduct, foster, and encourage scientific research and to teach, train, inform, and educate the public concerning the fundamental relationships between the soil and all kinds of animal and plant life.

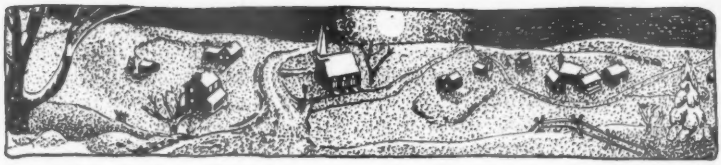
(c) To study the effects of organic and artificial fertilizers on soil and all kinds of life.

(d) To establish and equip laboratories, experimental farms, special institutions, and all manner of agencies to accomplish the purposes of the Foundation.

The directors and other officers of the Foundation are giving freely of their time and help without cost. We invite all who want to have a share in the work of the Foundation to send their contribution, much or little, to the Secretary, 46 South West Street, Allentown, Pa. All who contribute become associate members and receive all publications of the Foundation.

Extra copies of the Soil and Health Foundation News can be had by writing to the Secretary.

MINERALS AND TRACE ELEMENTS
in the current issue
and
THE HIDDEN WORLD
in the November, 1948 issue
are chapters from a forthcoming book by Leonard Wickenden
"MAKE FRIENDS WITH THE LAND"
to be published by the Devin-Adair Company
New York, N. Y.



Garden Calendar—December

December is the month for finally tucking in the plants for winter. The garden theme for the month may be expressed by the word, *mulching*. In the woodlands, the leaves have fallen and are layered on the ground over the roots of the trees and shrubs in the form of a thick blanket or mulch. The herbaceous plants of the woods have withdrawn completely into the leafy mulch and are thus protected from sudden temperature changes in the winter months. In the fields the herbaceous plants have also died down to the ground level and the dead tops of the plants form a natural mulch to prevent the alternate freezing and thawing of the soil during the changing temperatures of the winter and early spring months. Over Canada and the northern parts of the United States Nature gently spreads a layer of snow which serves as a most efficient mulch during the coldest parts of the winter. In our gardens we can do no better than imitate nature in mulching our plants. Especially suitable for this purpose are peat moss, ground leaves and other plant materials, sawdust, salt hay, straw, and other plant materials which are free from weed seeds. For permanent mulches, stones are recommended.

THE NORTH

Flower Garden:—Bulbs of lilies and of the wild species of tulips may still be planted. Cut down the hardy chrysanthemums and leave the tops over the plants as a mulch to help hold the snow and protect the plants during the winter. Cut down the stems of hollyhocks and foxgloves, and over the roots should be placed some brush with leaves mixed in as a mulch. These plants will be smothered if the mulch over them is too heavy. Other flowering plants which prefer a light rather than a heavy mulch are the irises, coreopsis, daisies, pinks, and primroses. Net your tree peonies with wire and cover them with leaves for winter. Prepare your excess flower seeds, collected from your own flower garden and from your choicest plants, for Christmas gifts by putting them up in neat and colorful seed packets. Your friends will appreciate choice seeds more than almost anything else you might give them. It is a remembrance that lasts through the year.

Vegetable Garden:—Be sure that all dead plants have been removed from the vegetable garden and put into the compost heap. This simple sanitary measure goes a long way toward the control of diseases in the vegetable garden. Far more attractive also is a neat, orderly garden seeded in winter rye than one

having half frozen vegetables of various kinds lying about in a disorderly fashion. Many of the garden insects hibernate in garden wastes. Why allow these pests to spend the winter in your garden?

Shrubs and Trees:—Shrubs and trees may be pruned safely providing the branches are not frozen. Among those that may be pruned at this time are climbing roses, honeysuckle, lilac, and mock orange. Tender shrubs, as boxwood and daphne should be protected by erecting a light wood frame, to be covered later with burlap. Evergreens that need trimming should be trimmed about two weeks before Christmas, and the trimmings should be saved for Christmas decorations. These trimmings should be kept in a cool, dark place and sprinkled occasionally. By this conditioning process, the leaves and fruits will remain on the evergreen branches longer than if they are taken directly from the tree at Christmas time. Fruit trees should be protected from rabbits and field mice by placing hardware cloth around the stem. The old canes of blackberries and raspberries should be cut out if this has not already been done. Newly planted trees should be anchored against the winter winds. After the ground is frozen, all trees will be benefited by a suitable mulch. Before the ground freezes, mulch the rhododendrons, azaleas, and newly planted conifers after having given them a thorough application of water.

Mulching:—Strawberry beds, perennial beds, and all other plants not specifically mentioned above should be mulched just as soon as the ground is frozen. This will prevent the alternate freezing and thawing of the ground which is so harmful to plants.

THE WEST COAST

The perennial border may be renewed by taking up the plants, separating them, and resetting them in freshly spaded and compost-enriched soil. Among the perennials may be planted dwarf gladiolus for succession of bloom.

Lilies may be planted in soil that has been lightened with sand and enriched with compost. At this time also Montbretia bulbs may be planted. A must in California gardens is Christmasberry (*Heteromeles arbutifolia*) to add Christmas cheer to the garden. Sweet peas should be planted now for spring bloom.

Cacti are now dormant and should be watered seldom or not at all.

THE SOUTH

Flower Garden:—Plant bulbs such as fritillarias and mariposa tulips. Prepare new flower borders by spading the soil and enriching it with compost and bone meal so that it will be ready for planting later. In the deep South, plant Easter lilies, callas, amaryllis, and day lily (*Hemerocallis*).

Trees and shrubs:—This is the time to transplant trees, as oak, holly, ginkgo, and tulip tree. Shrubs which produce their flowers on current season's growth may be pruned at this time. This also is the best time to transplant roses, hydrangeas, holly, and oleanders. Various shrubs and vines may be propagated by layering throughout the winter months. Also cuttings may be made and placed in a trench out of doors for rooting. By spring they will have rooted and may be planted out in rows in the garden or nursery. Azaleas should be kept well watered during the winter.

Vegetable Garden:—Set out asparagus, rhubarb, cabbage, and strawberry plants. This also is the time to plant seeds of many vegetables. Refer to your Agricultural Experiment Station bulletins or get a copy of our garden calendar.

Books by Dr. Ehrenfried Pfeiffer

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THE EARTH'S FACE AND HUMAN DESTINY

Nothing is so stimulating as a look at the earth's surface as a whole. The total life of a region is commonly referred to as a landscape. Dr. Pfeiffer discusses the landscapes of the earth in relation to the geological and biological forces which have been responsible for them. Beauty may be defined as harmonious expression. A beautiful landscape is biologically sound. When we upset Nature's balances and expose the earth's face to destructive forces we destroy beautiful landscapes and convert them into something artificial and ugly. This book deals with healthy and diseased landscapes through all phases of their deterioration or improvement—problems of the plain, the mountains, the woodlands, and the parks and gardens. Man has been more destructive to the earth's face than almost any geologic agent, and he must be constructive in shaping his environment or it may become a barren wasteland.
Cloth. 183 pp., 60 illus., frontispiece in four colors. **$2.75**

BIO-DYNAMIC FARMING AND GARDENING

The author asks his readers to look back to the agricultural practices of yesteryear when the farmers and gardeners followed the course of nature in tilling the soil, in planting, and in harvesting in an almost instinctive manner. Gradually emphasis was shifted from nature's ways to the ways of man, from an economy based upon the soil to one based upon the dollar. In simply written but masterful style, the author surveys the world situation in agriculture, the farm in its wider connections, soil as a living thing, and proper feeding of the soil to maintain its fertility and productiveness. Comments are made on forestry, gardening, the dynamic activities of plant life, the relation of fertile soil to health, and practical results of the bio-dynamic method of farming, a method based upon the return of all plant and animal residues to the soil whence it comes. *Cloth.* 240 pages, 18 illus. **$2.50**

GROW A GARDEN

In this small book, Dr. Pfeiffer gives undivided attention to problems of the garden and is quite chatty with the gardener. In the first line he puts his finger on the essence of the good life, namely self-sufficiency. This involves careful planning and a full understanding of nature's ways. First consideration is given to the home garden and the planting of gardens and homesteads. The author discusses size and yield, digging and cultivation, watering and irrigation, the preparation of composts and fertilization, sprays and spraying, and hotbeds and coldframes. For tops in gardening one must understand the value of crop rotation, the significance of mixed culture. He concludes with practical cultural directions for various vegetables in the home garden and the importance of herbs in the home and on the farm. *Paper.* 118 pp., illus. **$1.40**

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CROP MANAGEMENT AND SOIL CONSERVATION by Joseph F. Cox and Lyman C. Jackson—Second Edition. (John Wiley & Sons, New York, New York. 1948 $3.80)

This book deals with the major operations that will enable the grower to grow and market specific crops successfully. Special note is taken of the achievements of recent years in developing a national program directed toward the production of increased food during the war years and post-war period of world-wide starvation, the balancing of crop production, and the conservation of soils. The authors stress their purpose to aid individual growers in improving their crop rotations and in increasing their profits through efficient production methods. The nature and conservation of the soil is treated far too briefly for a permanent agriculture. Thirty-two tables and over two hundred illustrations.

ESTABLISHING AND OPERATING A FLOWER BUSINESS, U. S. Department of Commerce. Industrial Series No. 79 by James P. Emerson. (Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. 25 cents)

This booklet of about 50 pages offers basic information and counsel on establishing and operating a flower shop. It contains practical suggestions on all aspects of the management and operation of the small flower shop.

ESTABLISHING AND OPERATING A GROCERY STORE, by Nelson A. Miller, Harvey W. Huegy, et al. of the U. S. Department of Commerce. Industrial Series No. 21. (Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. 1946 55 cents)

This book of 375 pages gives basic and authorative facts that should be considered in beginning and operating a grocery store. It should serve as a practical guide for the person who is thinking of opening his first store and prove helpful to those already in business. There are 23 chapters concerned with all phases of the grocery business.

Legal Aid Society

Our attention has been called to a number of situations in the practice of the organic method of gardening that require legal interpretations. For example, can an agent of the State or Federal Government compel a gardener to use poisonous sprays on his food or ornamental plants to kill insects? Or, has a representative of a Board of Health the authority to prevent a citizen from building a compost heap in connection with making organic fertilizer for his garden? We suggest that all attorneys who are readers of Organic Gardening magazine and who believe in the natural methods of the organiculturists organize themselves into a Legal Aid Society. To join this society, we invite you to send your name and address to Organic Gardening, Emmaus, Pa.

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NOTICE TO READERS

The ORGANIC GARDENING Magazine does not accept advertising of chemical fertilizers or other fertilizers which we feel are too strong for the land or poisonous sprays. We do not deny firms access to our advertising columns if they handle chemical fertilizers if they have another acceptable product to sell. The reader should be careful in accepting such advertisements. Our responsibility extends only to the product advertised in our magazine. It does not extend to all of the products handled by a concern.

ORGANIC GARDENING Emmaus, Pa.

Compost

Clinic . . .

In the previous compost clinics consideration was given to the green matter, the manure, the soil, and the rock dusts that are used in building a compost heap. The compost heap is inhabited by a hidden world—a world of organisms that are far too small to be seen without the aid of a high-powered microscope.

These organisms we shall discuss in a later clinic. In this clinic let us give some attention to the physical conditions that must prevail in the heap to enable the inhabitants of this hidden world to thrive. In the first place there must be sufficient moisture, for no organisms can live without water, and they grow and reproduce most rapidly when the amount of moisture present is optimum for them. If too much water is added to the compost heap, it becomes sodden or soggy. This sodden condition interferes with proper aeration and the materials in the compost heap are apt to putrefy instead of ferment. Putrefaction is decomposition brought about by anaerobic organisms. Putrefactions are accompanied with disagreeable odors and the formation of decomposition products and gases which cannot be used in the nutrition of higher plants. If the heap has insufficient water, on the other hand, the growth and reproduction of the soil organisms and, therefore, the rate of decomposition of the organic materials in the heap will be diminished or even brought to a stop. It is important, therefore, to get just the right amount of moisture in each layer of the compost

heap. The water should be added with a hose or sprinkling can to each layer as the heap is constructed.

Equally as important as water in the compost heap is air. All the beneficial organisms in the soil are aerobic. That is to say, they need the oxygen from the air to live. It is highly important, therefore, that the compost heap be well ventilated. This can be facilitated by putting a lattice of brush on the ground as a longitudinal axis where the heap is to be built. This will permit a free flow of gases longitudinally through the heap. Then when the heap is completed and at intervals of 3 or 4 feet, holes should be punched from the surface to the brush at the base of the heap. This will make possible a free flow of gases from the atmosphere into the heap and from the interior of the heap out into the atmosphere. The rate of activity of the soil organisms can be controlled somewhat by the amount of air that is admitted to the interior of the heap.

A suitable temperature, such as prevails during the summer months, is best for the organisms in the heap. As the average daily temperature decreases in autumn and winter, the decomposition in the heap slows down gradually and almost stops altogether during the coldest parts of the winter. Winter composting can be done in places where the temperature will permit it, as in a greenhouse, basement, or ground cellar. It is even possible to insulate a compost heap outdoors so that the decomposition processes take place during the winter. This may be done by enclosing a compost heap by a larger enclosure and filling the space between the two enclosures with leaves, hay, straw, sawdust, or other insulating plant material. An insulated composter works especially well when earthworms are used instead of bacteria and fungi exclusively for the breaking down processes. Then again, a pit 3 or more feet in the ground will absorb some heat from the earth and thus tend to provide a more favorable temperature in winter than prevails in a heap built

Basic Garden Reading

THE COMPOST GARDENER
by F. C. KING

An English gardener relates his method of growing food crops by the organic plan. This book is so revealing that we imported it for the benefit of health-conscious America. Cardboard covers. Foreword by Sir Albert Howard. $1.00

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by DR. THOMAS J. BARRETT

It takes Nature about a thousand years to create an inch of top-soil. In his four centuries on this continent Man has just about depleted the top-soil. The lowly earthworm, because of its habits, can help humanity to save itself—if it will only do so. Dr. Barrett points out the value of the earthworm and tells us what to do about harnessing it to domesticity. Cloth, fully illustrated. . . $2.50

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directly on the surface of the ground.

For the development of sufficient heat of fermentation to kill weed seeds and any disease-producing fungi that may be present on the plant materials used in building the heap, a compost heap should be at least 4 or 5 feet square and 5 feet high. In large heaps it is not uncommon for the temperature to rise as high as 160 degrees F. Compost subjected to such a temperature will be free from all seeds and all disease-producing fungi. This is not the most important difference between compost and uncomposted manures.

Unfavorable conditions in the heap so far as water and air are concerned can be prevented by taking care that materials are not put in, in such a manner, that they tend to pack into tight layers. This is apt to be the case if large amounts of leaves are used without grinding them or mixing them with other plant materials. By far the most ideal physical conditions in the heap can be provided by grinding the plant materials, or even all the materials, before they are used to build a heap. The finer the particles of matter, the faster they will be broken down.

Compost Correspondence .

PUTREFACTION

Q. How can one differentiate between fermentation and putrefaction in the compost heap?

A. The way to differentiate it is by means of odor. In putrefaction there is always a disagreeable odor, while fermentation is characterized by a slight smell which is usually quite pleasant. Fermentation is brought about by aerobic bacteria which depend on oxygen in their respiration, but putrefaction is caused by anaerobic bacteria, an undesirable type that can live and work without oxygen

usually where there is too much water. In the anaerobic process gases are given off which have unpleasant odors.

—o—

SLUDGE

Q. What is the best method to use sewage sludge?

A. In the first place it must always be composted with other material but since it is usually lumpy it should first be broken up. This can be done by working it thoroughly with a hoe. It must be broken up and thoroughly aerated. Sludge will be broken down much better if, before it is placed in the compost heap it is thoroughly treated with the bacteria product called ActivO, advertised in *Organic Gardening*.

—o—

CESSPOOL OVERFLOW

Q. I have a large cesspool about 30 feet back of my house, which catches everything from the home. This cesspool has an overflow pipe running down a hill about 200 yards from the house. The overflow from the barn meets this overflow pipe about 100 yards from the end.

If I put a 500 gallon tank at the end of this line, will I be able to use this overflow safely for watering my garden and my compost pile?

A. By no means use this water on the garden. It contains undecayed elements that would be dangerous. Apply it to the compost heap and be sure it is thoroughly composted.

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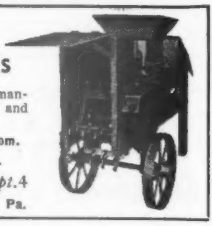

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MOLE CRICKETS

Q. Please advise me what to do to get rid of mole crickets.
Mrs. A. D. E., Tampa, Florida.

A. Mole crickets live in the soil where they do eat the roots of some plants as potatoes, pot herbs, and flowers, but they prefer to eat insects and worms. On the whole they must be regarded as beneficial soil organisms. It is possible that conditions arise when they make a nuisance of themselves. Perhaps the best way to get rid of them is to put down pieces of meat as traps. The mole crickets may be caught as they feed on the meat.

—o—

RED STELE IN STRAWBERRY

Q. Is there any indication or have you carried out any experiments to determine whether strawberry plants infected with the trouble known as "red stele" or "stele root rot" will throw off the disease if planted in ground heavily composted?
J. C. S., Tyler, Texas.

A. We have not observed the efficacy of a heavily composted soil in controlling the "red stele" rot in strawberries. The plants on the Organic Gardening Experimental Farm are growing in a rock garden in soil that

Rhododendron Catawbiense
(LILAC PURPLE)
2-3 Feet — 12 for $10.00 — 100 for $60.00
No Catalogue
ROBT. McEWIN RFD 4, Charlotte, N. C.

is well composted. These plants are in their third or fourth year and have never shown any signs of any disease. The leaves remain deep green even into fall and winter. These results would seem to indicate that strawberry plants which are well composted and mulched are relatively resistant to the common diseases and insect pests.

—o—

PETUNIAS

Q. I raise a considerable number of petunias, primarily celestial rose, snow queen, white perfection, and blue admiral. These plants grow and bloom in great profusion beginning about the middle of July. About the third week in August the blooms begin to get small, the stems of the plants become woody and hard, and the plants themselves become very rampant in growth. Have these plants just naturally bloomed themselves out for the season, or am I failing to do something necessary for continuous bloom until frost which usually appears in September or October?

F. Y. P., New York, N. Y.

A. It seems likely that your petunia plants become exhausted as a result of the production and maturing of seeds. This can be prevented by cutting them frequently for bouquets, or by picking off the flowers as soon as they begin to fade. Early exhaustion of the plants can also be helped by further enriching the soil with compost which will provide the plant with much needed nutrients and will conserve water for the warm, bright days of August.

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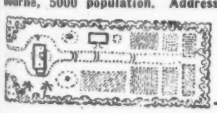

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ORGANIC GARDENING INDEX
July to December 1948 Inclusive

AUTHORS

	Month	Page
Abrams, Edwin H.		
Quick Return Method Succeeds	Nov.	25
Applegate, Charles V.		
Double Chrysanthemum-flowered Sunflowers	July	42
Balfour, Lady Eve		
No Digging	July	44
The Late Sir Albert Howard	Sept.	18
Bedier, Julie		
Lilies Are Easy to Grow	Oct.	40
Bridger, Roy		
Compost and the Croft	Sept.	44
Byers, Calvin A.		
A Compost Farmer	Nov.	31
Caldwell, R. A.		
Insulated Composter	Oct.	45
Cummings, M. B.		
Persian Clover?	Oct.	27
Eyster, Dr. William H.		
Botany for the Gardener (9)	July	39
Botany for the Gardener (10)	Aug.	30
Botany for the Gardener (11)	Oct.	22
Botany for the Gardener (12)	Nov.	36
Botany for the Gardener (13)	Dec.	26
Celery—Popular Salad, Flavor and Vegetable Plant	July	24
Earthworms		
Living Subsoilers and Composters	Dec.	37
Gladiolus Growers Prefer Organic Methods	Oct.	29
Hints for the Flower Garden	Oct.	28
Hints for the Flower Garden	Nov.	42
Organic Gardeners' Digest	July	49
Organic Gardeners' Digest	Aug.	41
Organic Gardeners' Digest	Nov.	47
Pit Green Houses	Oct.	20
Sir Albert Howard—Student of Nature	Sept.	23
Geiser, Melvin G.		
Brushings of a Rainbow	Nov.	26
Gifford, Professor John C.		
Leaf Fall	Oct.	46
Haas, H. C.		
Sir Albert Howard—Respecter of All Forms of Life	Sept.	41
Hawkes, Alex D.		
The Cannon-Ball Tree	Nov.	18
Howard, Sir Albert		
Last Editorial	Sept.	42
The Progress of Organic Agriculture in the U.S.A.	Sept.	42
Howard, Lady Louise E.		
The Birth of the Organic Farming Movement	Sept.	15
Hulsebus, R. E.		
Magic in the Garden—Compost in the Soil	Aug.	20
Hylton, W. G.		
Compost for Trees and Herbs	Nov.	25
Ingham, Arnold G.		
Save the Bumble Bee	Nov.	49
Kirkham, Ellinor		
Sir Albert Howard—Prophet and Champion of the Soil	Sept.	25
Lamon, Chaerin		
Organic Garbage Disposal	Aug.	28
Lemmon, Lawrence		
Keep a History of your Soil	Nov.	32
Lutman, B. F.		
The Scientific Work of Sir Albert Howard	Sept.	29

	Month	Page
Martin-Leake, H.		
Sir Albert Howard—An Appreciation	Sept.	27
Nelson, Avery		
One Man's Garden	Dec.	35
Pfeiffer, Adelheid		
Homemade Bread—the Staff of Life	July	28
Pfeiffer, Ehrenfried E.		
Basic Ideas of the Indore and Biodynamic Methods	July	19
New Standards of Soil and Health	Oct.	15
Protect Birds	Nov.	15
Sir Albert Howard's Deed for Science	Sept.	20
The Physical Structure of the Soil	Aug.	23
Picton, Dr. J. L., O.B.E.		
Sir Albert Howard—Master Farmer of India	Sept.	39
Ridley, Basil		
Miraculous Change on a Small Farm	Sept.	43
Rodale, J. I.		
A Trip to Alabama	Nov.	12
Grinding Leaves	Dec.	12
Sir Albert Howard—A Tribute	Sept.	13
The Church and the Farmer—A Plan	Oct.	12
The Place of Protein in the Organic Method	July	12
The Potash—Protein Relationship	Aug.	12
Sams, E. H.		
What a Lifetime Has Taught Me	Aug.	46
Seton, Lady		
Sir Albert Howard—A Man of the Whole World	Sept.	37
Shrager, John		
Plan Ahead When You Buy Nursery Stock	Dec.	30
Sisk, Carl M.		
His Excellency, the American Bluebird	Dec.	46
Smith, Roger W.		
Health and Humus	Dec.	41
Organic Methods	Nov.	39
Wad, Yeshwant D.		
The Work at Indore	Sept.	6
Walbridge, H. F.		
Cabbages Excel in Compost	Oct.	26
Walmsley, Margaret Hazledine		
Orchids, My Hobby	Oct.	32
Watson, E. Fairlie		
The Lessons of the East	Sept.	9
Whallon, Archer P.		
Two Oriental Vegetables—Chinese Cabbage and Chinese Mustard	July	17
White, Herbert Clarence		
A Knight in Shining Armour	Sept.	34
Crazy Man's Orchard	Aug.	32
Organic Methods Restored This Farm	July	32
Wickenden, Leonard		
Minerals and Trace Elements	Dec.	16
The Hidden World	Nov.	20
Wilde, E. I.		
Perennial Garden Phlox	Dec.	22
Williams, Gurnee (Mrs. Wm.)		
Strawberries in Rocks	Aug.	39

SUBJECTS

A		
Acid Loving Plants	Aug.	55
Actinomyces	July	39
Actinomyces Griseus	Dec.	42
Activo, Biological Activator	Oct.	53
Aeration of the Soil	Aug.	24
Aerobic, Definition of	July	41
Amaryllis	Nov.	42
Annuals for the Tulip Bed	Oct.	39
Antibiotic, Definition of	July	41
Artificial Fertilizers convert soil into Cement	Oct.	8
B		
Bacillus Brevis	Dec.	42
Balance in Plant Nutrition	Aug.	42
Bees, Harder Working	Nov.	47
Biennials in Early Spring	Nov.	43
Biodynamic Method, Basic Idea	July	19
Birth of the Organic Gardening Movement, The	Sept.	15
Blueberries, Fertilizers for	Aug.	60
Bluebird, The American	Dec.	46
Books, Review of New		
Azaleas—Kinds and Culture H. Harold Hume	Aug.	51
Care and Culture of African Violets Loyd Putnam Lindsey	Oct.	49
Crop Management and Soil Conservation J. F. Cox and L. C. Jackson	Dec.	53
Establishing and Operating a Flower Business, U. S. Department of Commerce	Dec.	53
Establishing and Operating a Grocery Store U. S. Department of Commerce	Dec.	53
Farmers' Handbook Eastern States Cooperative 1948	July	52
Guide to Eastern Ferns Edgar T. Wherry	Aug.	53
Introduction to Genetics and Cytogenetics Herbert Parkes Riley	Oct.	49
Malabar Farm Louis Bromfield	July	52
Our Living Forests Joseph T. Hazard	July	52
Our Plundered Planet Fairfield Osborne	July	53
Our Plundered Planet Fairfield Osborne	Aug.	53
Protohistory H. C. E. Zacharias	Aug.	51
Solly's Flower Book Annual Flowers by Cecil Solly	Nov.	52
Stubble-Mulch Farming to Hold Soil and Water Farmers' Bulletin No. 1997 U. S. Department of Agriculture	Nov.	52
The American Farmer Lee Fryer	July	53
The Farmers' Hand Book John M. White	Aug.	51
The Universe in the Making J. E. R. McDonagh	Oct.	49
Woman's Home Companion Garden Book John C. Wister	Nov.	52
Botany for the Gardener		
Plants in the Soil (9) Actinomyces	July	39
Plants in the Soil (10) Slime Molds	Aug.	30
Plants in the Soil (11) The Molds	Oct.	22
Plants in the Soil (12) The Yeasts	Nov.	36
Plants in the Soil (13) The Higher Fungi	Dec.	26
Bread, Homemade, Recipe	July	29
Breadmold	Oct.	22
Bulbs now for Easter Blooms, Plant	Nov.	43
C		
Cabbage, Chinese	July	17
Calla	Nov.	42
Cannon-Ball Tree, The	Nov.	18
Caterpillars, How to Eliminate Small	Oct.	58
Cattails for Compost	Oct.	54
Celery	July	24
Cellulose, Definition of	July	41
Ceresan poisoning of Swine	July	50
Cesspool Overflow	Dec.	57
Chemicals, Those Destructive	Oct.	4
Chrysanthemum	Nov.	48
Chrysanthemums, Control time of flowering	Oct.	39
Chrysanthemums, Winter Care of	Nov.	42
Church and the Farmer, The—A Plan	Oct.	12
Clam Shells	Nov.	51
Colloid	Dec.	17
Common Blue Mold, Penicillium	Oct.	24
Compost, Acid	Nov.	51
Compost, Alakaline	Nov.	51
Compost and the Croft	Sept.	44
Compost for Trees and Herbs	Nov.	35
Compost for Wet Soils	Oct.	53
Compost in the Soil	Aug.	21
Compost Magic to Fruit Trees	July	9
Compost, Peat	Aug.	55
Compost, When to Apply	Nov.	54
Composter, Insulated	Oct.	45
Composts, Different	July	58
Copper Sulphate kills Soil Organisms	July	49
Corn, Mining the Soil with	July	49
Cover Crop	Aug.	60
Cover Crops for Vegetable Crop Soils	Nov.	47
Crab Grass	July	41
Cutworms	Aug.	7
D		
Dahlia Roots, Storing	Oct.	38
Dolomite	Aug.	15
Dolomite in compost	Nov.	51
Dried sewage Sludge	Nov.	55
E		
Earthworm, the Longitudinal Section	Dec.	36
Earthworms		
Nature's Subsoiler	Dec.	37
Nature's Composter	Dec.	38
In Compost Pits	Dec.	39
Garbage Composter	Dec.	39
Earthworms and Soil Aggregation	Aug.	42

Earthworms and Soil Fertility .....Oct. 59
Earthworms and Spray .....Dec. 3
Earthworms, Hybrid .....Nov. 61
Earthworms in the Compost Heap .....Aug. 59
Egg Shells .....Nov. 51
Erosion .....Nov. 46
Evergreen Cuttings .....Nov. 43
Evergreen Cuttings, When to make ....July 60

F

Farm, Restored .....July 32
Fermentation .....Dec. 56
Fertilizers and Insect pests .....Aug. 9
Flavor in Foods .....Aug. 41
Flax waste .....Nov. 61
Flies in Garbage .....July 60
Fragmentation, Definition of .....July 41
Fresh Manure vs. Compost .....Aug. 61
Fruit trees, treatment of .....Aug. 33
Fungi, The Higher .....Dec. 26

G

Garbage Disposal, Organic .....Aug. 28
Garden Calendar
Gladiolus .....Oct. 29
Gladiolus Corms .....Nov. 10
Ground-up Leaf, Uses of .....Dec. 14

H

Hammermill .....Dec. 12
Hardpan in the Soil .....Aug. 23
Hardware Cloth .....Dec. 13
Hints for the Flower Garden .....Oct. 38
Hints for the Flower Garden .....Nov. 42
Howard, Sir Albert Memorial number...Sept. issue
Humus .....Dec. 41
Humus and Flavor in Apples .....Aug. 41
Hybrid Problem, The .....Oct. 48
Hypya, Definition of .....July 41

I

Indore Method, Basic Idea .....July 19
Insects, Control of Orchard .....Nov. 60
Insect infestation .....Aug. 18
Iris .....Nov. 26
Iron rust in compost .....Nov. 58

K

Keep a History of Your Soil .....Nov. 32
Kelp .....Nov. 51
Knight in Shining Armour, A .....Sept. 34
Kodachrome Slide Library .....July 45

L

Land Values .....Aug. 43
Lawn Seed, Sowing .....July 59
Leaf Fall .....Oct. 46
Leaf mulching .....Aug. 34
Leaves .....Nov. 51
Leaves for the compost heap .....Nov. 56
Leaves, Grinding .....Dec. 12
Lessons of the East, The .....Sept. 9
Liebig .....Aug. 17
Lignin, Definition of .....July 41
Lilies .....Oct. 40
Lilies Planted in November .....Nov. 43
Lilies, Winter Care of .....Nov. 42
Lime, Kinds of .....Oct. 54
Liquid Compost .....Oct. 55
Loafing Sheds .....Aug. 37

M

Magnolias, Transplanting .....Nov. 59
Manure, composting .....Nov. 56
Manure in the Compost .....July 54
Manure on crop yields, Effect of .....July 50
Miraculous change on a Small Farm ..Sept. 43
Molds, The .....Oct. 22
Mole Crickets .....Dec. 58
Morning Glories, Control of wild .....Nov. 59
Mulch for Evergreens .....July 59
Mulching Time .....Oct. 58
Murate of Potash .....Dec. 16
Mustard, Chinese .....July 17
Mycelium, Definition of .....July 41

N

Nature's Autumn Plant Exhibit .....Nov. 30
Nematode Control .....Nov. 47
New Standards of Soil and Health .....Oct. 15
News From the Clubs .....Sept. 3
No Digging .....July 44
Nursery Stock .....Dec. 30

O

Organic Agriculture in the U. S. A., The Progress of .....Sept. 42
Organic Fertilizer, Definition of .....Oct. 57
Organic Garden Clubs .....Aug. 29
Organic Gardeners' Digest .....July 49
Organic Gardeners' Digest .....Aug. 41
Organic Gardeners' Digest .....Nov. 47
Organic Method Adopted .....July 23
Organically Grown Seeds, How Superior .....July 60
Oriental Vegetables .....July 17
Orchids .....Oct. 32
Our Readers Mourn the Passing of Sir Albert Howard .....Sept. 51
Oyster Shells .....Nov. 51

P

Peaches, Mosaic .....Nov. 58
Pecans, Fruiting .....July 7
Penicillium .....Oct. 24
Penicillium notatum .....Dec. 42
Peonies, Transplanting .....Oct. 34
Persian Clover .....Oct. 37
Petunias .....Dec. 59
Phosphorus for plants .....July 50
Phlox, Garden, Perennial .....Dec. 22
Physical Structure of the Soil, The ...Aug. 33
Pine Needle Mulch for Strawberries ...Nov. 8
Pit Greenhouses .....Oct. 30
Plants, Arrangement of .....Nov. 15
Potash Drunkards .....Aug. 16
Potash, Sources of .....Nov. 58
Potash-Protein Relationship .....Aug. 13
Potato Blight Fungus .....Oct. 23
Potatoes, Chemical Fertilizers Spoil ...July 19
Powdery Mildew .....Oct. 23
Protein, Health tied to .....Aug. 14
Protein in the Organic Method .....July 12
Protect Birds .....Nov. 15
Pruning Spring-Flowering Shrubs .....July 60
Putrefaction .....Dec. 53

R

Red Stele .....Dec. 53
Rocks for mulching .....July 60
Rhubarb .....Nov. 47

S

Sawdust .....Oct. 57
Schrumpf-Pierron .....Aug. 14
Screen, Hardware Cloth .....Dec. 14
Seedlings, Tall and Limber .....Aug. 61
Segmented, Definition of .....July 41
Sewage Sludge .....Dec. 57
Skunks and insects .....July 59
Slime Molds .....Aug. 30
Slugs .....Aug. 7
Slugs in Mulched Plants .....July 60
Snails .....July 60
Snakes in garden .....Aug. 58
Sodium Carbonate .....Dec. 13
Soil and Health Foundation, The .....July 43
Soil and Health Foundation, The .....Aug. 19
Soil and Health Foundation, The .....Sept. 4
Soil and Health Foundation, The .....Oct. 25
Soil and Health Foundation, The .....Nov. 50
Soil and Health Foundation, The .....Dec. 49
Soil in the Compost .....Oct. 50
Soil in the Compost heap, Purpose of ..July 58
Soil Profiles .....Aug. 27
Soil Reaction and Vegetables .....July 31
Soil, Sour .....July 59
Soils, Desert .....Aug. 12
Soils, Semi-Arid .....Aug. 26
Stems in the compost .....Nov. 55
Strawberry, New .....July 50
Strawberries in Rocks .....Aug. 39
Subsoiling .....Aug. 24
Subsurface Tillage and Nitrogen .....Aug. 41
Sunflowers, Double Flowered .....July 42
Sunflower seeds, opening .....July 8
Surface Irrigation .....Aug. 26
Sweet Pea .....Dec. 21
Sweet Peas, Fall Sowing .....Oct. 39

T

Testing Physical Structure of the Soil .Aug. 26
Toadstools in the compost heap .....Nov. 55
Tomatoes and No Blight, Composted ..Nov. 6
Tomatoes like Bushes .....July 8
Tractors Are Increasing Danger of Soil Abuse .....Nov. 14
Treatment of Orchard and Berry Soils...Aug. 25
Treatment of Wet Soils .....Aug. 25
Tree Roses, Winter Protection For ....Oct. 33
Trip to Alabama, A .....Nov. 12
Tulips .....Nov. 38
Tulips, Planting .....Oct. 39
Tyrothricin .....Dec. 42

U

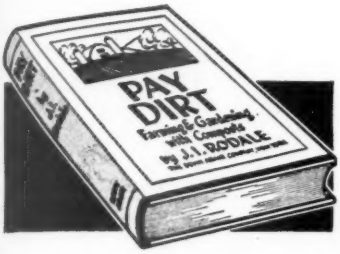
Unwilted grass .....Aug. 53

V

Vegetables, Care of Harvested .....Nov. 47
Vetch .....Oct. 27
Vitamin Plants, High .....Aug. 4

W

Walnut Stocks .....Nov. 43
Water and NPK content of common manures .....July 57
Water hyacinths .....Nov. 51
Weeds in composted Plants .....Nov. 57
Wheat, Hard and Soft .....Aug. 13
Wheat, High-yielding Giant .....Nov. 47
White Flowered Plants for Shady Places .....Oct. 38
Work at Indore, The .....Sept. 6
Yeasts and Compost .....Nov. 38
Yeasts, The .....Nov. 38



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